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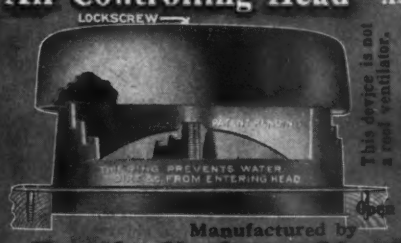

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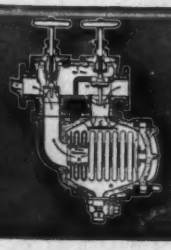
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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK APRIL, 1916

Determination of Radiator Sizes for Hot Water Heating Plants

WITH CHARTS FOR SIMPLIFYING CALCULATIONS.

BY FREYWID WEGELIUS.

NOTE.—Regarding the different heat emitting capacity of steam and hot water radiators, the writer's opinion on this question is supported by the very careful experiments made at the testing station for heating and ventilating apparatus at Charlottenburg, Germany, and which also accord fully with the results obtained from several other experiments. This phenomenon may be explained as follows: When water is flowing through a radiator, only a small portion of its particles are striking the inner surfaces of the radiator, and the greater number of particles are thus running through the radiator without touching the surfaces. When steam is flowing through the radiator there is, due to the mobility and condensation of the steam, a continuous current of steam particles flowing towards the inner sides of the radiator, causing an intimate contact between the steam particles and the radiator surface. Thus the heat from the whole steam mass is directly emitted through the radiator surfaces, differing in that respect from hot water heating, where only a part of the heat is directly emitted.

The general expressions of M (B.T.U. transmitted by the total radiator surface per hour), as shown in a previous article on this subject (see THE HEATING AND VENTILATING MAGAZINE for January, 1916) and here reproduced, enable the engineer to obtain the amount of heat emitted by a 1-, 2-, 3-, or 4-col. radiator of a known size and for all temperature differences. As in Europe radiators of the Ideal type (made by the American Radiator Company) are very commonly used, the accompanying charts, I, II., III., and IV., are based upon this type of radiator.

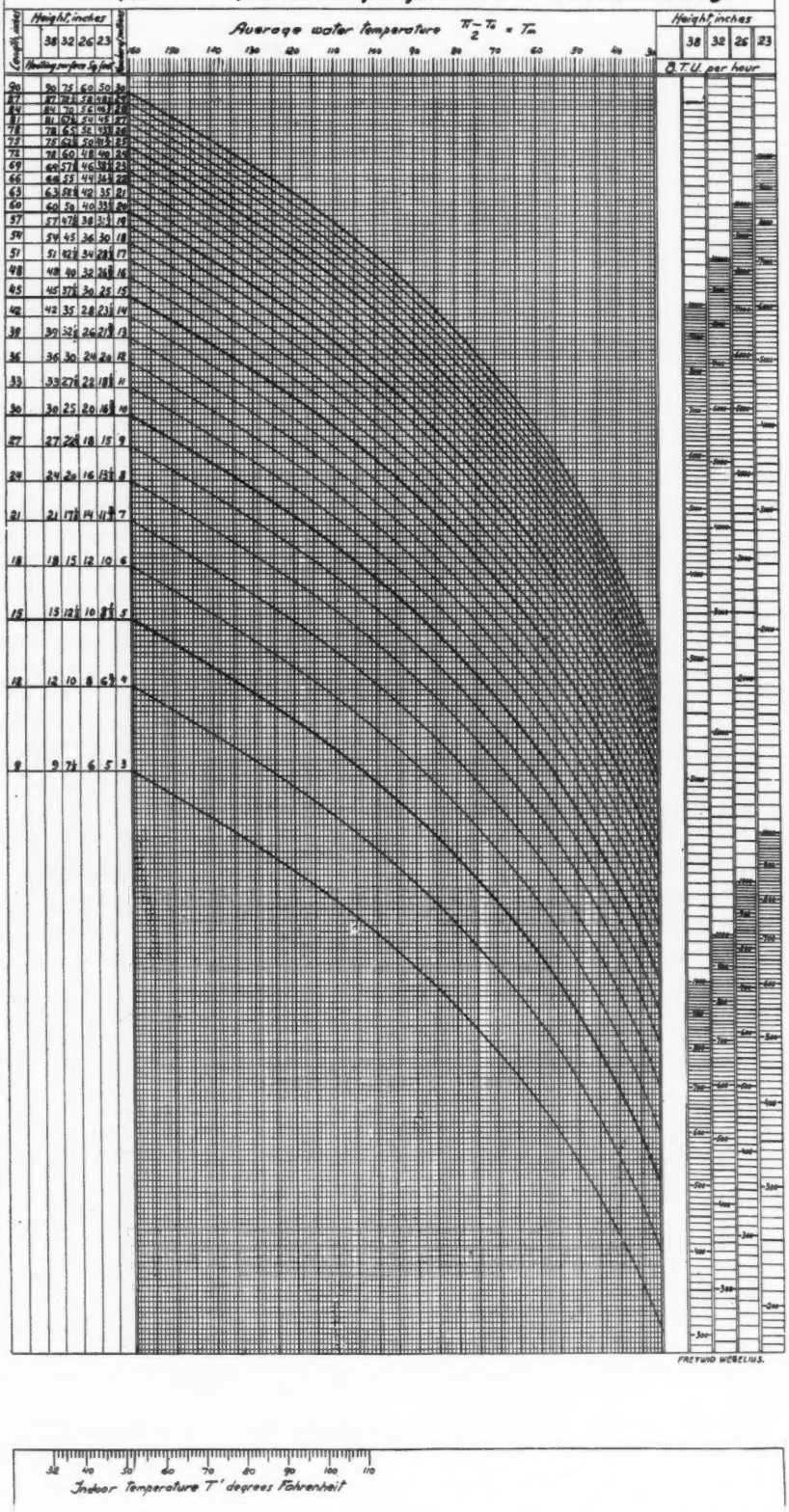
First let us consider Chart II. for 2-col. radiators which are those mostly used. We may put the average water temperature as

$$T_m = \frac{T_1 - T_0}{2}$$

GENERAL EXPRESSION OF

	K	R	M
1 and 2 column radiators	$1.043 \frac{T_d^{0.151}}{h^{0.13}}$	$\frac{1}{1.043} \frac{h^{0.13}M}{T_d^{1.151}}$	$1.043 \frac{T_d^{1.151}R}{h^{0.13}}$
3 column radiators	$0.944 \frac{T_d^{0.151}}{h^{0.13}}$	$\frac{1}{0.944} \frac{h^{0.13}M}{T_d^{1.151}}$	$0.944 \frac{T_d^{1.151}R}{h^{0.13}}$
4 column radiators	$0.882 \frac{T_d^{0.151}}{h^{0.13}}$	$\frac{1}{0.882} \frac{h^{0.13}M}{T_d^{1.151}}$	$0.882 \frac{T_d^{1.151}R}{h^{0.13}}$

Chart 1. Graphic chart for determining sizes of the American Radiator Company's "Ideal" 1 column radiators.



(*Copies of charts* 1-4, 11½ x 23 *in., will be sent postpaid to any address on receipt of* 25 *cents.*)

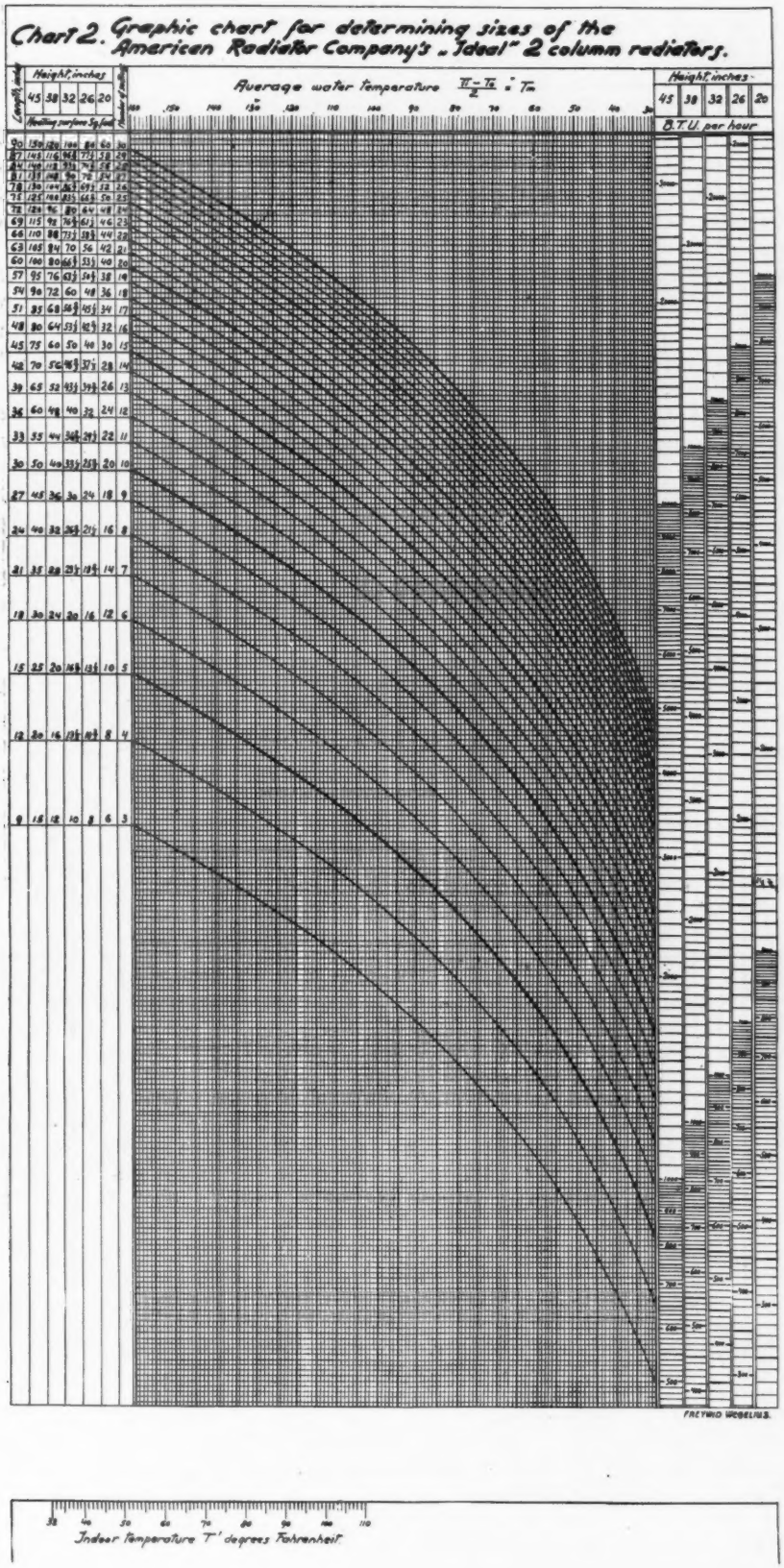


Chart 2. Graphic chart for determining sizes of the American Radiator Company's "Ideal" 2 column radiators.
Average water temperature $\frac{T_1 - T_2}{2} = T_m$
Height, inches
45 38 32 26 20
B.T.U. per hour
Length, inches
Number of sections
Indoor temperature T' degrees Fahrenheit
FREYMO WEGELIUS.

(Copies of charts 1-4, 11½ x 23 in., will be sent postpaid to any address on receipt of 25 cents.)

T_1 being inlet, and T_0 outlet water temperatures. Each curve on the chart represents five different radiators, of the same length and number of sections, but of different heights and surfaces. On the right side of the chart there are five scales corresponding to the B.T.U. emitted by the different heights. On the left there are seven columns, five of which indicate the surface corresponding to the different heights, and two the length and number of sections.

As one is not likely to figure on indoor temperatures below 32° F., the charts have been based on this indoor temperature. For any indoor temperature above 32° it is necessary to use a temperature rule the scale of which is drawn on the lower margin of the chart.

The only calculation to be made before using the chart is to subtract the number 32 from the average water temperature T_m. Let us call this difference $T_{d32} = (T_m - 32)$

If, for instance, the average water temperature in a heating plant be 180° F., then $T_{d32} = 180 - 32 = 148$. A 45-in. high radiator, we will say, is required, with a heat emitting capacity of 3,000 B.T.U. per hour. To determine the needed surface, number of sections and length of radiator, place the temperature rule horizontally on the chart at a height corresponding to 3,000 B.T.U. on the 45-in. scale and with the number 32 of the temperature rule on the vertical 148-line, also called the T_{d32} line. Now, if the indoor temperature is 32° F., follow the curve that is nearest to the intersecting point between the vertical 148-line and the temperature rule. This will give the number of sections which equal 3, and in the 45-in. column the surface is found to be 15 sq. ft., and in the furthest column the length equals 9 in.

If the indoor temperature is above 32°, as is generally the case, and if the other conditions are unchanged, the temperature-rule is held exactly in the same place, and the curve that is nearest to the indoor temperature in question on the temperature rule say, 66°, is followed to the columns on the left side, where the number of sections, surface and length of radiator are directly read. In this way, in the case mentioned, one

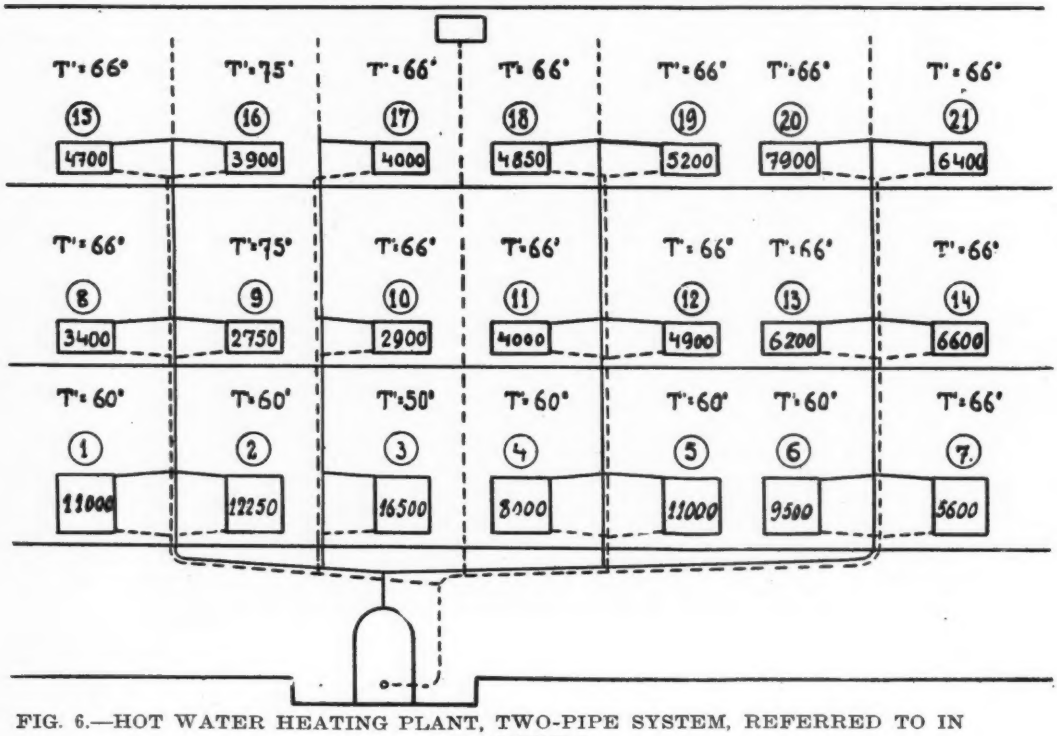


FIG. 6.—HOT WATER HEATING PLANT, TWO-PIPE SYSTEM, REFERRED TO IN EXAMPLE 1.

gets for an indoor temperature of 66°, four sections 45-in. high, 2-col., 20 sq. ft. and 12 in. length of radiator. An indoor temperature of 85° would require five sections of the same type, with 25 sq. ft. of surface and 15 in. length, and so on.

If for another hot water heating plant, the conditions are changed as follows: Average water temperature 125° F., type of required radiator, 2-col. 26-in. high; and its heat emitting capacity 5,500 B.T.U. per hour, in that case T_{d32} becomes 125 — 32 = 93, and for an indoor temperature of 55°, the required radiator will be: Number of sections, 22; surface, 58 2/3 sq ft.; length, 66 in. An indoor temperature of 62° would give 25 sections, 66 2/3 sq. ft. and 75-in. length, and so on. The other charts are used in a similar manner.

To simplify the matter the writer generally uses table-forms as employed for the examples below.

Example 1. Hot water heating plant, two-pipe system, without regarding cooling effect by the pipes. Average water temperature $= \frac{190+140}{2} = 165$; $T_{d32} = 165 - 32 = 133$. For the sake of space no plan drawings are used, but only elevations. On the first floor there are 10

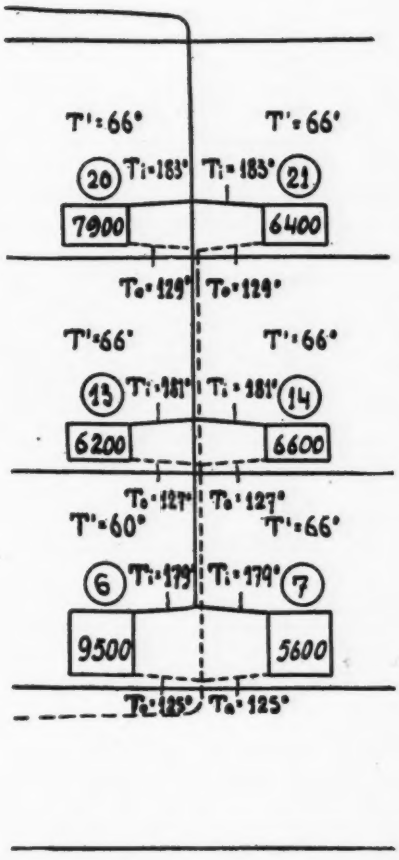


FIG. 7.—TWO-PIPE SYSTEM REFERRED TO IN EXAMPLE 2.

Room No.	T_{d32}.	Indoor temp. T'.	Heat emitting capacity M.	Heating surface, sq. in. 45-in.	38-in.	32-in.	26-in.	20-in.	Radiator sections and heights.
First Floor—									
1	133	60	11,000	80	..	..	..	..	16/45 (II)
2	133	60	12,250	90	..	..	..	..	18/45 (II)
3	133	50	16,500	110	..	..	..	..	22/45 (II)
4	133	60	8,000	60	..	..	..	..	12/45 (II)
5	133	60	11,000	80	..	..	..	..	16/45 (II)
6	133	60	9,500	70	..	..	..	..	14/45 (II)
7	133	66	5,600	45	..	..	..	..	9/45 (II)
Second Floor—									
8	133	66	3,400	..	..	..	24	..	9/26 (II)
9	133	75	2,750	..	..	..	21⅓	..	8/26 (II)
10	133	66	2,900	..	..	..	21⅓	..	8/26 (II)
11	133	66	4,000	..	..	..	29⅓	..	11/26 (II)
12	133	66	4,900	..	..	..	34⅔	..	13/26 (II)
13	133	66	6,200	..	..	..	48¾	..	13/26 (III)
14	133	66	6,600	..	..	..	52½	..	14/26 (III)
Third Floor—									
15	133	66	4,750	..	..	..	34⅔	..	13/26 (II)
16	133	75	3,900	..	..	..	32	..	12/26 (II)
17	133	66	4,000	..	..	..	29⅓	..	11/26 (II)
18	133	66	4,850	..	..	..	34⅔	..	13/26 (II)
19	133	66	5,200	..	..	..	37⅓	..	14/26 (II)
20	133	66	7,900	..	..	..	65	..	13/26 (IV)
21	133	66	6,400	..	..	..	52½	..	14/26 (III)

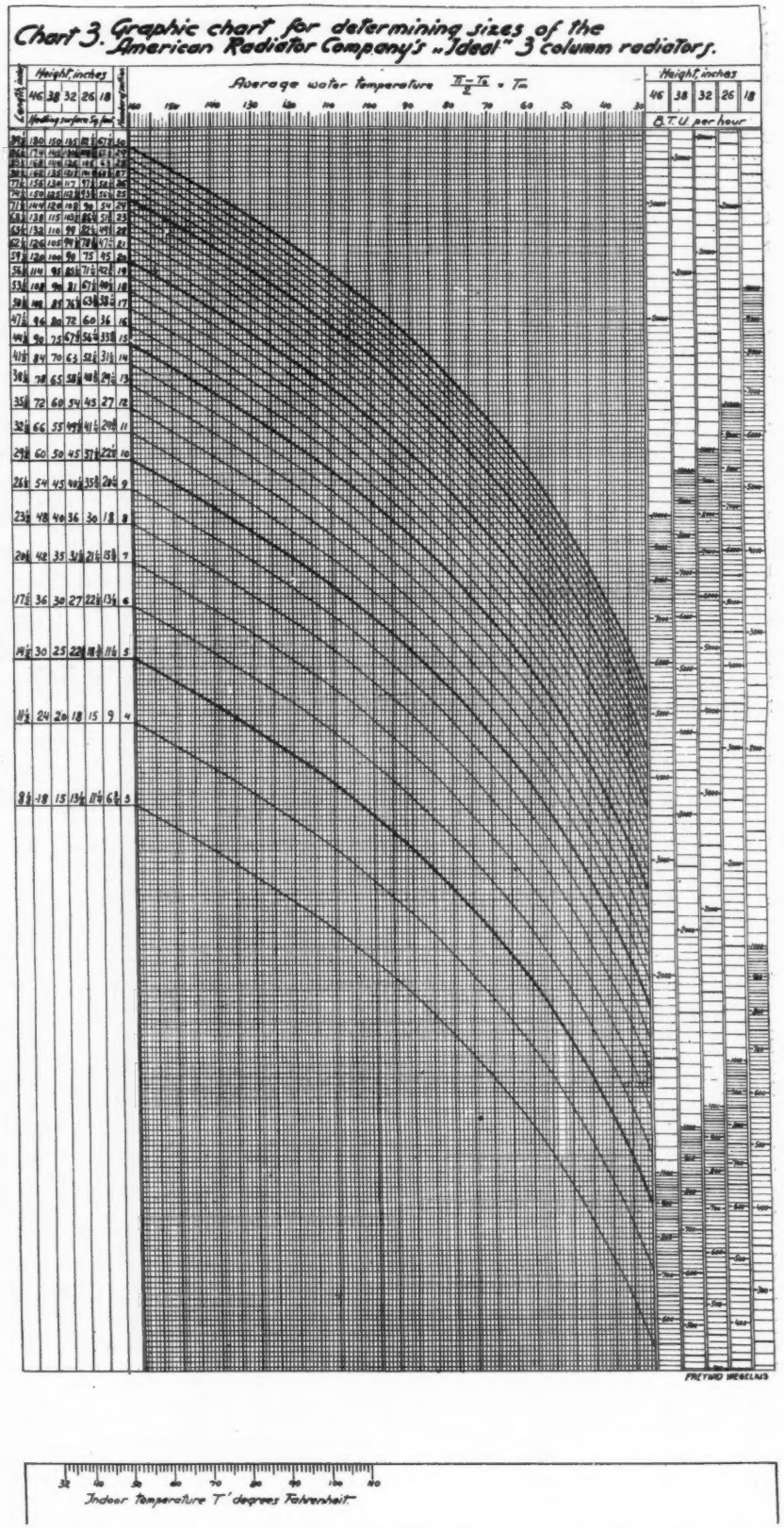


Chart 3. Graphic chart for determining sizes of the American Radiator Company's "Ideal" 3 column radiators.
Average water temperature $\frac{T_1 - T_2}{2} = T_m$
Height, inches
46 38 32 26 18
B.T.U. per hour
Indoor Temperature T' degrees Fahrenheit

(*Copies of charts* 1-4, 11½ x 23 *in., will be sent postpaid to any address on receipt of* 25 *cents.*)

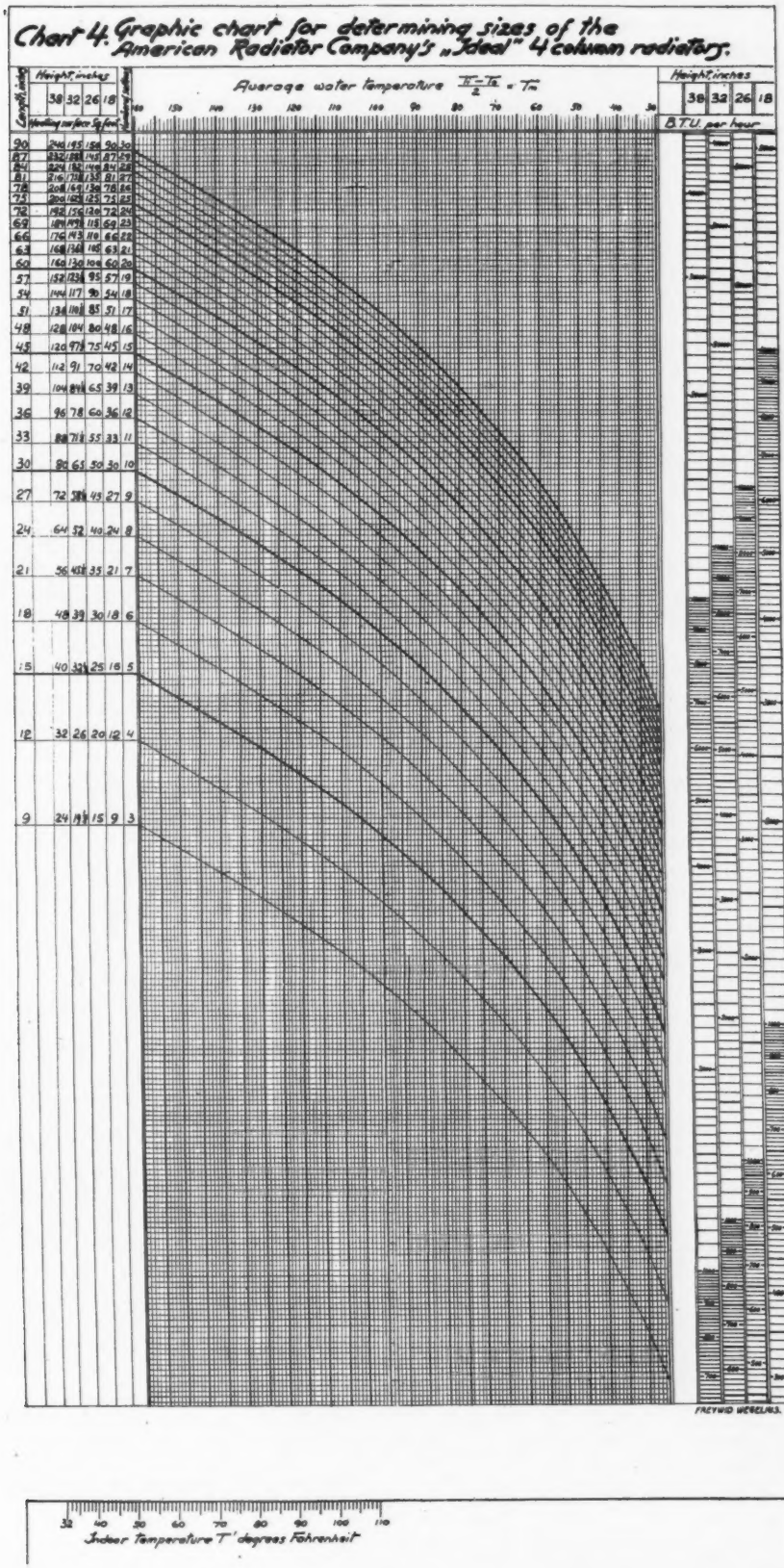


Chart 4. Graphic chart for determining sizes of the American Radiator Company's "Ideal" 4 column radiators.
Average water temperature $\frac{T-T_r}{2} = T_m$
Height, inches
38 32 26 18
Heating surface Sq. feet
Length, inches
BTU. per hour
FREYWID WEGELIUS.
Indoor Temperature T° degrees Fahrenheit

(*Copies of charts* 1-4, 11½ x 23 *in., will be sent postpaid to any address on receipt of* 25 *cents.*)

be used 45-in. high radiators, on the second and third floor 26-in. high radiators.

Example 2. Two-pipe system, cooling effect of pipes regarded. Hot water inlet and outlet temperatures for each radiator taken out from Fig. 7.

might be expressed by a similar equation which would also include the thickness of the wall, velocity of air etc. In fact, several tests of that transmission through building materials, made with electric radiators by G. Andersson, G. Huber, A.

Room No.	T_{dsz}.	Indoor temp. T'.	Heat emitting capacity M.	Heating surface, sq. in. 45-in.	38-in.	32-in.	26-in.	20-in.	Radiator sections and heights.
7	120	66	5,600	55	..	..	..	..	11/45 (II)
14	122	66	6,600	..	..	..	53⅓	..	20/26 (II)
21	124	66	5,400	..	..	..	50⅔	..	19/26 (II)

Example 3. One-pipe system, without regarding cooling effect of pipes. Water temperatures according to Fig. 8 (see table below).

For a convenient use of the charts, the writer has had the indoor temperature scale marked on a wooden rule of the form shown below.

It is a simple matter to draw similar charts for any type of radiator. As a matter of fact, the writer is drawing charts of the same kind for steam radiators.

In the writer's preceding article in the January issue, there was mentioned the general equation for the heating emitting capacity of radiators. This equation

$$K = \alpha \frac{T_d^{\,tg\,\varphi}}{h^{\,tg\,\psi}}$$

has been deduced by the writer chiefly from tests made by Rietschel with hot water radiators. It has led to the supposition that the heat transmission through walls, ceilings, windows, etc.,

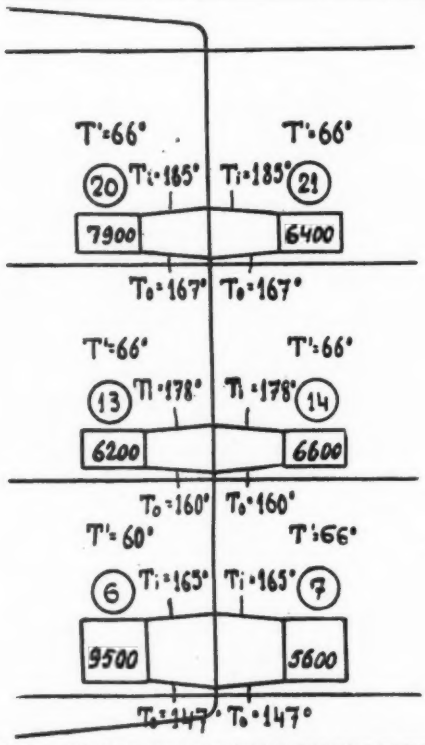


FIG. 8.—ONE-PIPE SYSTEM REFERRED TO IN EXAMPLE 3.

Room No.	T_{dsz}.	Indoor temp. T'.	Heat emitting capacity M.	Heating surface, sq. in. 45-in.	38-in.	32-in.	26-in.	20-in.	Radiator sections and heights.
7	124	66	5,600	50	..	..	..	..	10/26 (II)
14	137	66	6,600	..	..	..	45⅓	..	17/26 (II)
21	144	66	6,400	..	..	..	40	..	15/26 (II)

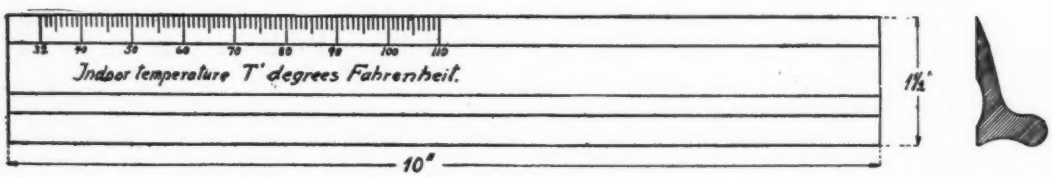


FIG. 9.—DESIGN OF WOODEN SCALE, MARKED WITH INDOOR TEMPERATURES.

Alftan and the writer at our laboratory in Helsingfors, Finland, show a good conformity to this equation, at least for a constant thickness and low air velocities. If this conformity is confirmed for greater ranges and grows into a new general law, which we hope to be able to demonstrate before long, one would be obliged later on to reckon with a changeable heat transmission factor, the value of which would also depend on the height of the transmitting surface.

Pipe Hangers

METHODS OF ARRANGING AND DETERMINING STRENGTH OF VARIOUS TYPES OF SUPPORTS

BY HAROLD L. ALT.

II.

If it is thought desirable to suspend the riser from the top, we have the set of hangers as shown in Fig. 11. Here hanger No. 7 carries the entire load of the riser and horizontal ceiling run, half way to hanger No. 6 Hangers Nos. 5 and 6 are the same as before shown in Fig. 8 and hanger No. 8 is a guide similar to the one shown in Fig. 10. To design hanger No. 7 (Fig. 12) we first obtain the load which, if we assume this as steam pipe, will consist of about 5 ft. of 8-in. W. I. pipe on first floor ceiling, one 8-in. C. I. flanged ell L. P., about 25 ft. of 8-in. W. I. pipe in riser, one 8-in. C. I. flanged ell at base and, say, another 5 ft. of pipe running half way to the next hanger. This totals 35 ft. of pipe at 28 lbs. per foot and

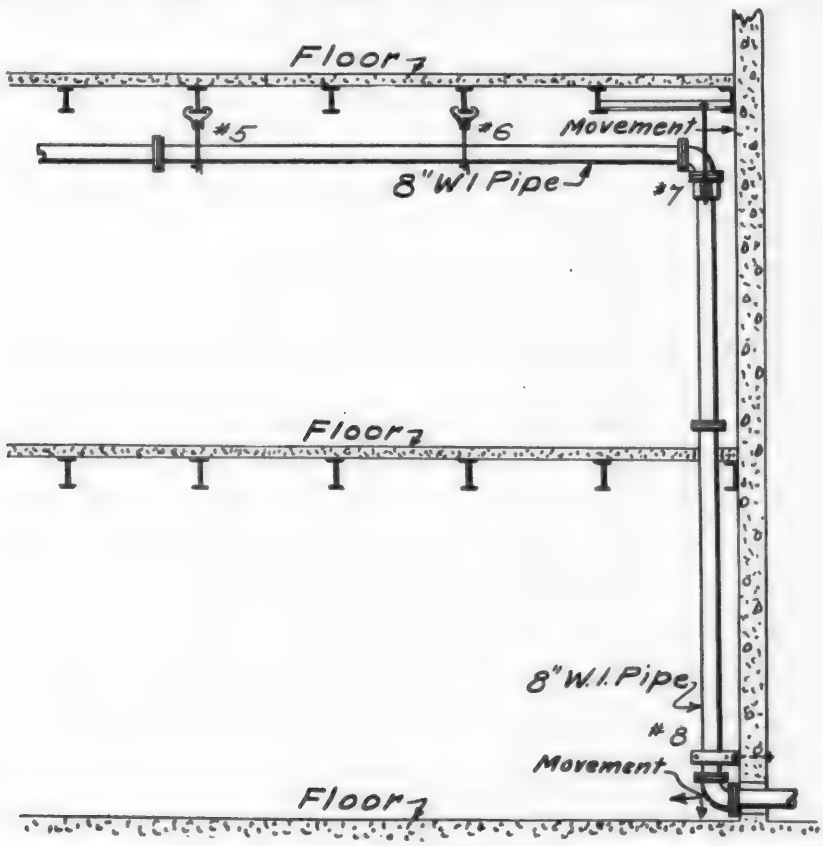


FIG. 11.—ARRANGEMENT OF HANGERS FOR SUSPENDING RISER FROM TOP.

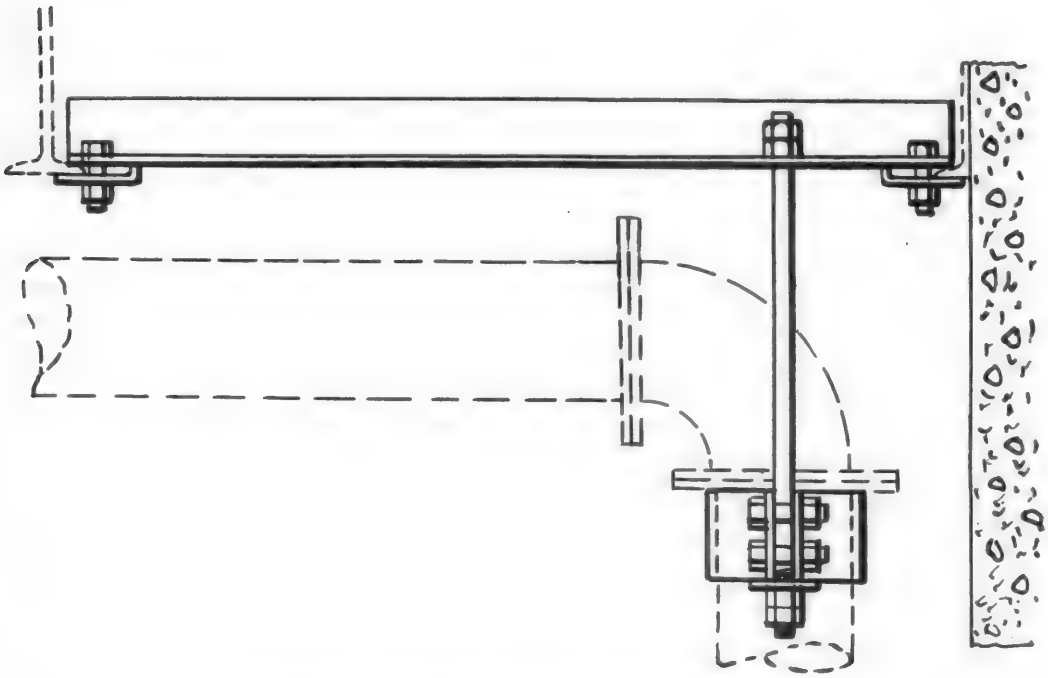


FIG. 12.—DETAIL OF HANGER NO. 7 (FIG. 11).

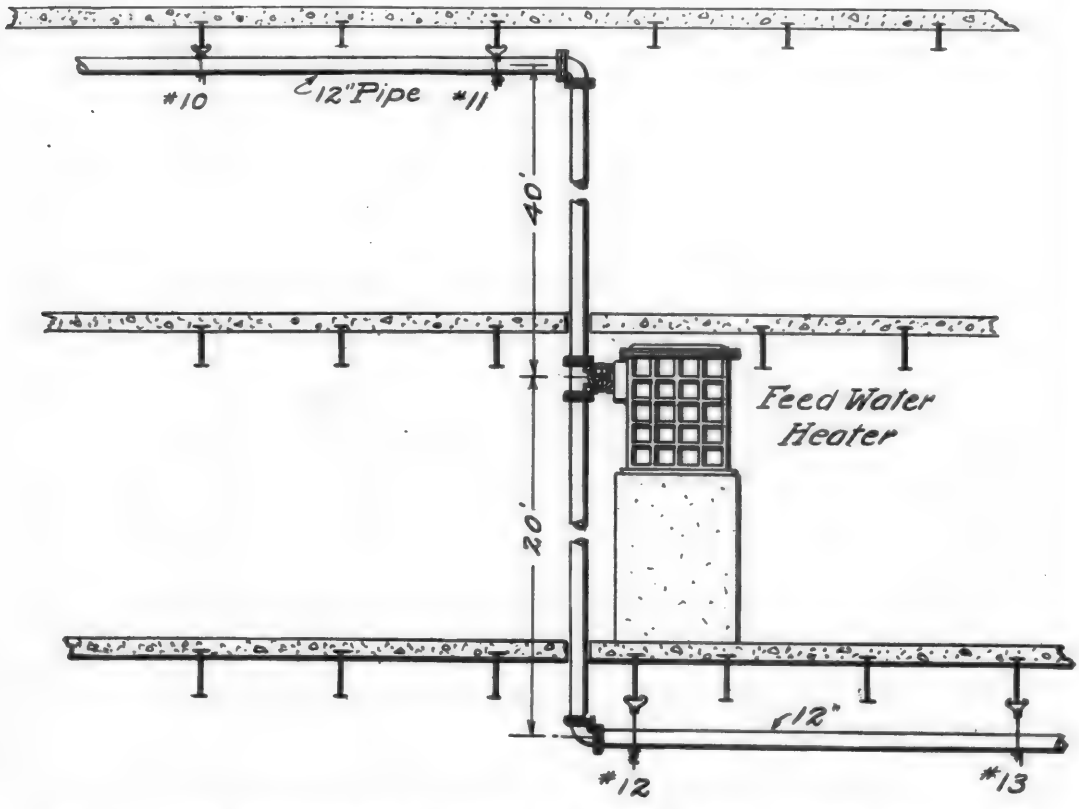


FIG. 13.—ARRANGEMENT OF HANGERS TO PROVIDE FOR VARYING CONDITIONS.

2 ells at 120 lbs. each, or a total load of 1,220 lbs. As this is steam pipe it might at some time become filled with condensation water so we will add 22 lbs. x 35 lineal feet or 775 lbs. for this contingency. This gives a total possible load of 1,220 plus 775 or 1,995, say, 2,000 lbs. Then each rod going down to the clamp will carry only 1,000 lbs. which, with stress of 8,000 lbs. per square inch, requires a cross-section area of 1,000 divided by 8,000 or ⅛ sq. in. The point where the rod is supported by the angle is so near one side that loading amounts to but little more in effect than if it were equally distributed. If the rod is 12 ins. from end of angle and the angle is 60 ins. long, the bending moment is equal to the beam load at either end times the distance between rod and beam in inches. The beam load is inversely proportional to the same distance. As the rod is one-fifth the distance of the total span away from channel, the I beam will carry one-fifth of hanger load and since the rod is four-fifths of the distance of the total span away from I beam, channel will carry four-fifths of load. The bending moment is then one-fifth of 1,000 lbs. x four-fifths of 60 or four-fiths of 1,000 lbs. times one-fifth of 60, according to which end you take and the result is the same, *viz.*, 9,600 divided by 12,000 = about 0.75 sectional modulus, required, or 3 in. x 3-in. x ⅜ in. angle, which has a sectional modulus of 0.83.

WHEN HANGERS MUST ADJUST THEMSELVES TO VARYING CONDITIONS.

There are some cases which may be encountered where pipe hangers must adjust themselves to varying conditions caused by expansion and there are any number of installations where such requirements can only be met by hangers of this type. To show this in simple form, let us take Fig. 13 in which low pressure steam pipe is carried through below one floor, then passes up through the floor, making a connection through a valve to a feed water heater and continues on up to second floor above where it runs horizontally over to a free exhaust outlet. If we assume that hangers have been decided upon at locations marked Nos. 10, 11, 12 and 13, hangers Nos. 10 and 13 may be dismissed from our consideration, as they are of the familiar clamp type, and we may devote ourselves to requirements of hangers Nos. 11 and 12. From tables of weights of fittings given in any fitting catalog we can compute the weight of pipe on hanger No. 11, assuming that this hanger carries half the weight from No. 10 down as far as the connection to the feed water heater. Starting with the pipe midway between hangers Nos. 10 and 11 and going toward feed water heater, we have approximately:

7 ft. of 12-in. standard weight pipe or 49 lbs. x 7 or	343 lbs.
1 ft. of 12-in. standard weight ell or 260 lbs. x 1 or	260 lbs.
38 ft. of 12-in. standard weight pipe or 49 lbs. x 38 or	1,862 lbs.
½ ft. of 12-in. standard weight tee or 390 lbs. x ½ or	180 lbs.
½ ft. of 12-in. standard weight valve or 1,200 lbs. x ½ or	600 lbs.
or a total of	3,245 lbs.

For hanger No. 12 we may assume that the piping from the heater connection down to half way between hangers Nos. 12 and 13 is carried by this support which makes the load as follows:

½ ft. of 12-in. standard weight tee or 390 lbs. x ½ or	180 lbs.
½ ft. of 12-in. standard weight valve or 1,200 lbs. x ½ or	600 lbs.
18 ft. of 12-in. standard weight pipe or 49 lbs. x 18 or	882 lbs.
1 ft. of 12-in. standard weight ell or 260 lbs. x 1 or	260 lbs.
9 ft. of 12-in. standard weight pipe, or 49 lbs. x 9 or	441 lbs.
or total of	2,363 lbs.

Now supposing this pipe is erected and carefully adjusted at hangers Nos. 11 and 12 so that practically no weight is brought on the valve connection at the heater. This means that hanger No. 11 will be tightened up until it carries approximately 3,245 lbs. and that hanger No. 12 will be adjusted until it carries about 2,363 lbs.

So far so good. But what happens when steam is turned into the pipe? Immediately the pipe expands and raises from its fixed point (which is at the heater connection) so as to take the load entirely off hanger No. 11 and to throw it onto the connection to the heater. This is almost sure to produce a leaky joint at this point, and in the meantime the pipe from the lower horizontal main to the heater has also expanded, which farther assists in leakage. If other conditions are equal, this pipe, which is 20 ft. long, will expand one-half as much

as the upper section, which is 40 ft. long, since it is only one-half the length. This expansion immediately results in a strong upward thrust on the heater connection and an equal downward thrust plus the weight of the pipe on the hanger No. 12.

Now what happens when this expansion takes place—for it is bound to take place! Either the heater must be lifted or the hanger No. 12 must deflect sufficiently to accommodate the expansion.

PIPE EXPANSION TABLE.

Let us see just how much this expansion will be. By reference to the table shown in Fig. 14, a great deal of tiresome computation can be avoided as this table shows at a glance the expansion in inches per 100 ft. for both wrought-iron and cast-iron pipe, either covered or uncovered. In this table the number of degrees rise in temperature is given across the top and the expansion for 100 ft. of pipe is given in the extreme left-hand column.

Assuming that this is low pressure steam pipe, we have an interior temperature which will be in the neighborhood of 220° F. and since piping in most modern installations is covered we would use the diagonal line marked "Covered Wrought Iron Pipe." If the room is at 70° F. normal temperature, the increase in temperature when the pipe is heated amounts to 220°-70°, or about 150°. Placing a pencil on the vertical line marked 150° and running down this line to the diagonals, the first diagonal we strike is that for "Covered Wrought-Iron Pipe" (which is the one to use in this case) and we find that covered wrought-iron pipe intersects with the 150° line at the horizontal line marked "1¼ in." which shows that 100 ft. of pipe under these conditions will expand 1¼ in. Since we have only 40 ft. above the heater, we have 40/100 of this amount or ½ in. and with 20 ft. below the heater we will, of course, have just half as much, or ¼-in.

These figures are small and yet a change of ½-in. or even ¼-in. in the length of these vertical risers is sufficient to transfer practically all of the load (which was previously adjusted so as to be carried by hangers) onto the heater connection and will invariably produce leaks at this point.

SPRING HANGERS.

The only way to overcome the difficulty satisfactorily is by use of spring

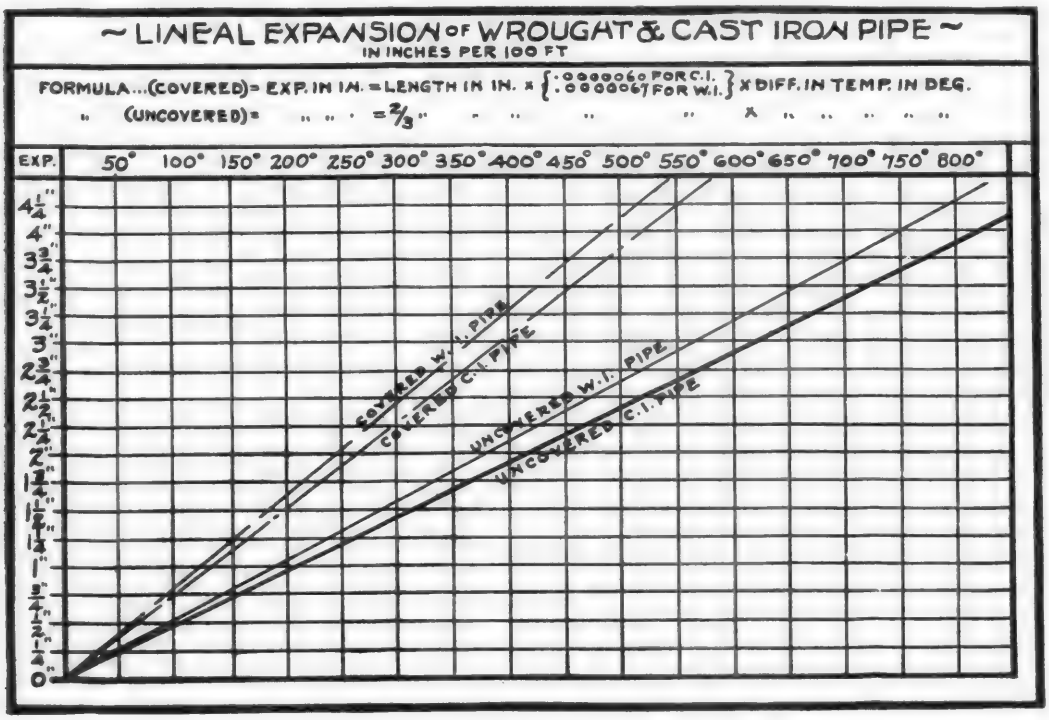

~ LINEAL EXPANSION OF WROUGHT & CAST IRON PIPE ~
IN INCHES PER 100 FT
FORMULA...(COVERED)= EXP. IN IN. = LENGTH IN IN. × {.0000060 FOR C.I. / .0000067 FOR W.I.} × DIFF. IN TEMP. IN DEG.
" (UNCOVERED)= " " " = 2/3 " " " " " " " " " " "
EXP.
50° 100° 150° 200° 250° 300° 350° 400° 450° 500° 550° 600° 650° 700° 750° 800°
4¼" 4" 3¾" 3½" 3¼" 3" 2¾" 2½" 2¼" 2" 1¾" 1½" 1¼" 1" ¾" ½" ¼" 0
COVERED W.I. PIPE
COVERED C.I. PIPE
UNCOVERED W.I. PIPE
UNCOVERED C.I. PIPE

FIG. 14.—PIPE EXPANSION CHART.

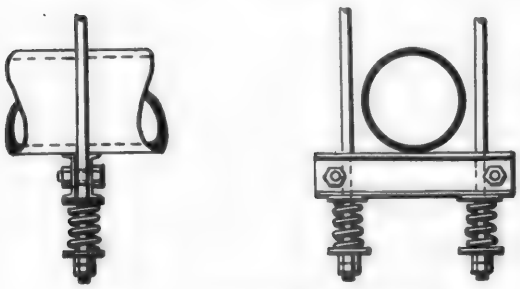


FIG. 15.—SPRING HANGERS.

hangers which may be somewhat of the type shown in Fig. 15 where two rods are carried through between 4-in. channels placed back to back and have springs located between the channels and nuts on the bottom of the rod. If there is room above the pipe sufficient to allow the use of the hanger shown in Fig. 16, it will be just as satisfactory and is cheaper than using two rods. In this design it is well to use a separator plate on the top of the channel to keep the middle rod in proper position, this plate having three holes, two being for the U-bolt and one being for the hanger rod. A still cheaper form of hanger, requiring only one spring, is shown in Fig. 17, but it must be remembered that a single spring will have to carry twice the load supported on the other two.

Springs can be designed in a general way from the tables and rules given in Kent's "Mechanical Engineer's Handbook," but they should always be ordered from the manufacturer with the guarantee to deflect a given amount with a given increase in the load, as temper and other characteristics vary in stock used by different spring makers.

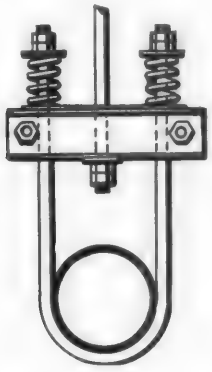


FIG. 16.—SIMPLE FORM OF SPRING HANGER.

It has been found advisable to assume that the spring will carry two-thirds of the load when in its open position, one and one-third times the load in its compressed position. Under these conditions a single spring for hanger No. 11 would carry two-thirds of 3,245 lbs. or 2,163 lbs. when open and 1 1-3x3,245 lbs. or 4,327 lbs. when compressed. The movement between the open position and the compressed position we previously found by the expansion table to be ½-in. If double springs are used, the movement will be the *same,* but for only one-half of the load, as each spring carries its own portion only.

On the lower hanger (No. 12) the load in the open position would be 2/3 of

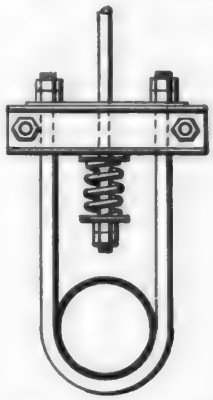


FIG. 17.—SPRING HANGER USING ONE SPRING.

2,360 lbs., or 1,575 lbs., while in the closed position the load would be 1 1/3 x 2,360 lbs. or 3,150 lbs.

This means that the spring will exert an upward thrust on the pipe when it is hot, but will not carry all of the load after the pipe has contracted; the difference between the loads carried in hot and cold conditions is transmitted, either down to the next hanger, or to some fixed point such as the heater connection. Yet, in any case, two-thirds of the load has been eliminated from the heater connection by the expansion and contraction action of the spring—something which cannot be accomplished by any other means.

Still another condition of expansion which must often be overcome is shown in Fig. 18, which is a plan view of two pipes joining together at the foot of a riser, pipe A expanding in the direction

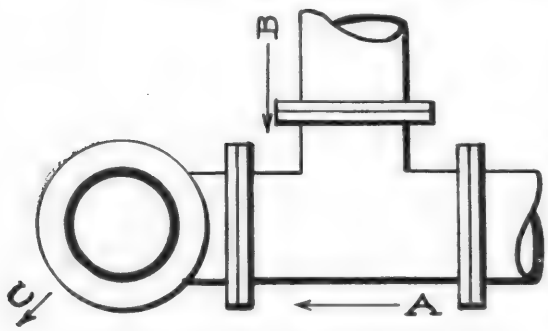


FIG. 18.—CONDITIONS OF EXPANSION REQUIRING CAREFUL TREATMENT.

indicated by arrow A and pipe B expanding in the direction indicated by arrow B; this gives a resultant expansion indicated by arrow C. If both of these pipes are heated and cooled together rollers can be placed under the base of the riser in such a way as to permit it to move back and forth along the direction indicated by arrow C, but if, by any possibility, these lines are valved in such a way that A may expand without B, then the riser moves in a direction indicated by arrow A, while if B is heated when A is cold the riser will move in the direction indicated by arrow B, the resultant movement indicated by C being attained only when both A and B expand together.

To accommodate such a condition (which is commonly met with at bases of exhaust lines or other large risers) a support can be used such as is shown in Figs. 19 and 20 which are side and end elevations of the piping shown in Fig. 18.

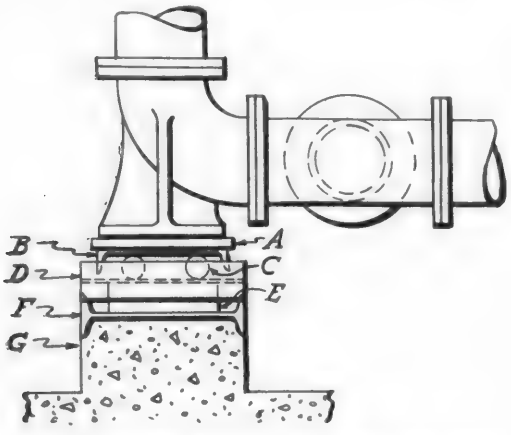


FIG. 19.—SOLUTION OF CONDITIONS SHOWN IN FIG. 18.

In Fig. 19 a base ell is first set on plate A which rests on the back of channel B. This channel is supported on two rollers C which allows movement in the direction indicated by arrow A, Fig. 18, these rollers rolling on web of I-beam D. I-beam D in turn is supported upon two rollers, E, turned at right angles to upper the rollers and moving over web of I-beam, F, which is supported on foundation, G; these lower rollers accommodate the expansion in the direction indicated by the arrow B, Fig. 18.

An end view, Fig. 20, indicates clearly how this support is made up, and it will be noted that the rollers are placed so as to make it impossible for them to slip out from under the riser, C rollers being retained by flanges on channel B and E rollers by flanges on I-beam D; similarly other flanges prevent rollers working out endwise and it will be found that this method of support will carry very heavy loads with only slight resistance to expansion.

Just a word in regard to the expansion table, Fig. 14. It will be noted that there are four lines showing expansion of pipe both "wrought-iron" and "cast-iron" and "covered" and "uncovered." The covered pipe is assumed to attain the same temperature as steam or other contents of pipe

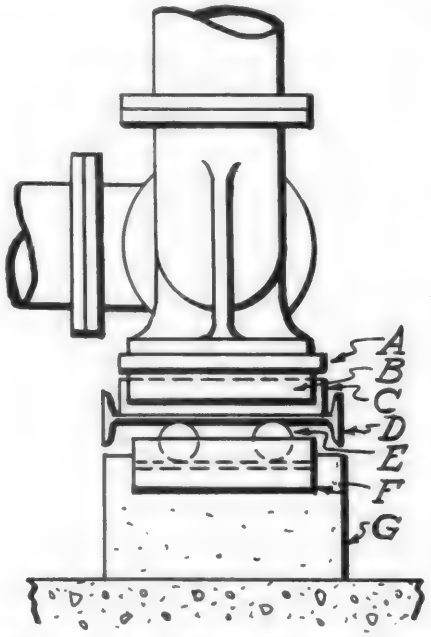


FIG. 20.—END VIEW SHOWING HOW SUPPORT IS MADE UP.

owing to pipe being protected by covering from cooling influence of surrounding atmosphere. Where pipes are uncovered it is assumed that the expansion is only two-thirds as much, owing to the outer skin of the pipe being cooled by air and, therefore, exerting a retarding effect on the expansion of the interior portions. This has been found to reduce the theoretical expansion approximately 33⅓%.

Window Leakage

Including Results of Important Tests on All Metal Windows

By Stephen F. Voorhees and Henry C. Meyer, Jr.

(*Presented at the annual meeting of the American Society of Heating and Ventilating Engineers, New York, January* 18-20, 1916.)

Almost all of the rules used in calculating the radiating surface necessary to warm a building, are based upon the assumption that the windows are reasonably tight. When wooden windows are used and it is found that the leakage is excessive, it is a simple matter to correct this fault by the application of weather strips. The introduction of the metal-clad window, that is, a wooden window covered with metal, has caused more or less trouble in heating buildings due to the difficulty of making a tight fit between the metal rubbing surfaces, but in this case also, methods of successful weather stripping have been developed.

The all-metal window, constructed of hollow or solid section members, is a most troublesome and serious factor, not only on account of its excessive leakage, but also because of its extensive use to meet the requirements for adequate fire protection.

EXPERIENCES WITH HOLLOW-METAL WINDOWS.

Several years ago one of the authors was called upon to design the heating and ventilating equipment for a building of some 5,500,000 cu. ft. capacity. When it was proposed to use hollow-metal windows, without weather strips, by the owners of the building, the heating engineer frankly stated that he was in a quandary as to the amount of heating surface necessary to warm the building on account of the variable, and at times, excessive leakage of windows of this type. After some discussion it was recommended that the rooms in the building be given about one-third more heating surface than would be required with reasonably tight windows, and if it was found that this increase failed to meet the situation, it would be better to attempt to stop the window leakage than to add still more radiating surface. Such a course was followed and it was found that in certain parts of the building the radiation supplied was not sufficient.

In another building for the same owners, the seven lower stories were equipped with hollow-metal windows and additional radiating surface was provided. The seven upper floors of the building were equipped with ordinary wooden windows made after the specifications and drawings of the architects, but with weather strips. When the building was finished, difficulty was experienced in heating the lower floors, but none whatever with the upper floors.

In all of the cases above mentioned the trouble was not experienced with all the rooms with the hollow-metal windows, showing, as was to be expected, that the leakage is a variable factor. This meant that in some rooms in which the leakage was more moderate, overheating occurred and naturally very serious overhetaing would occur in all of the rooms provided with an excessive amount of raditaion when temperatures were more moderate and with moderate outside wind velocity. This naturally produced a discomfort among the building occupants. Another interesting fact is worth recording in con-

nection with the building first mentioned. This is exposed on all four sides and in severe winter weather, the draft from the windows along the west wall was so great and the temperatures at these points so low that it was impossible for one to sit in these locations with any degree of comfort. Along the east wall of the building, however, on the same floor and at points only 40 ft. away, temperatures of over 75° to 80° F. were found, as against temperatures of 60° to 65° F along the west wall.

SCOPE OF WINDOW LEAKAGE EXPERIMENTS.

For the purpose of determining the relative merits of several methods of reducing this window leakage, the architects for the buildings mentioned, Messrs. McKenzie, Voorhies and Gmelin, began what has resulted in an extended series of experiments on window leakage. These tests have extended over a period of some twelve months and cover a large number of experiments on different types and different makes of windows, many of the windows being tested under variable conditions. When the tests were started it was supposed that practically all the air leaked through the crack between the sash and the frame and between the meeting rails; that is, it took place around the sash perimeter. It was soon found, however, that there was a very considerable leakage elsewhere than through the crack. The air came through the puttied joints of the glass, and through the connections of the muntin bars, and through the joints of the frame. Every window, therefore, was tested to determine the two classes of leakage, which are designated (1) "Sash perimeter leakage" and (2) "elsewhere leakage," the sum being the total leakage of the window.

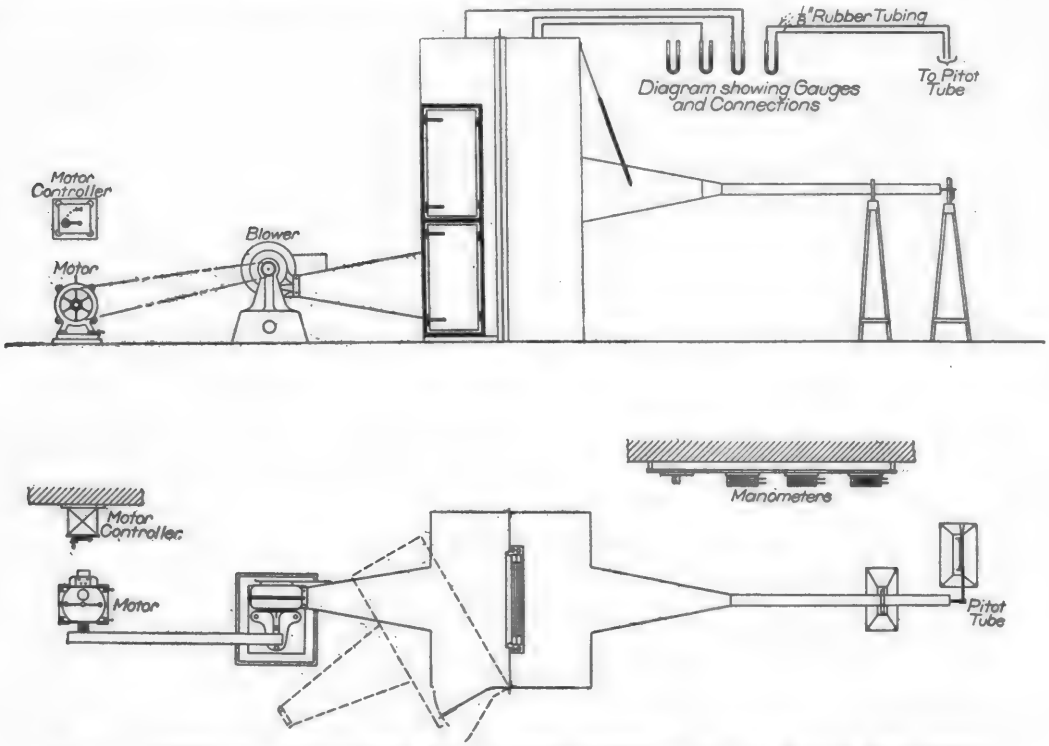


FIG. 1.—TESTING APPARATUS FOR DETERMINING AIR LEAKAGE THROUGH WINDOWS.

The tests were conducted in a space in the Chelsea Telephone Exchange building, with apparatus purchased for the purpose, by the New York Telephone Company. This apparatus consisted of a small Sirocco-type blower, belt-driven by a variable-speed direct-current motor. The window to be tested was placed in a

partition separating into two parts a chamber made of galvanized iron about 5 ft. x 5.5 ft. in plan and 9.5 ft. high, and so constructed as to be practically air-tight. The fan was arranged to discharge into one side of the chamber. From the other side extended a conical galvanized-iron pipe terminating in a smaller pipe.

turer, and (2) to determine the elsewhere leakage by puttying up the cracks, thus eliminating the sash perimeter leakage. Deducting the "elsewhere leakage" as determined by the second test, from the total leakage, determined by the first test, gives the "sash perimeter leakage."

Inasmuch as weather stripping affects

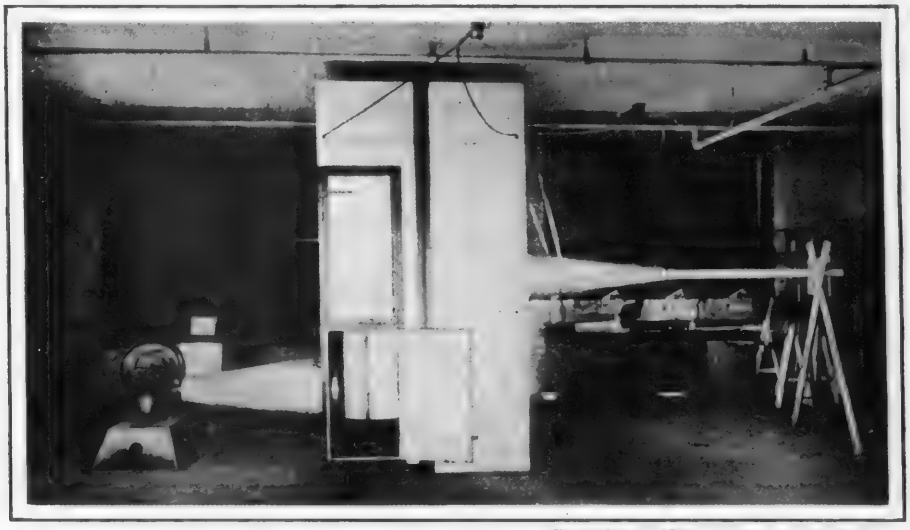


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FIG. 2.—GENERAL VIEW OF TESTING EQUIPMENT, SHOWING BLOWER, TESTING CHAMBER AND DISCHARGE PIPE.

A number of differential gauges were employed to record the pressure on each side of the window tested so that the differential pressure was obtained. Pitot tubes were employed to test the velocity of air through the discharge pipe mentioned. The quantity of air delivered by the fan could be varied by varying the speed of the fan and by throttling the inlet, and the pressures varied by the same means, also by sliding doors on the pressure side of the testing chamber. In each case tests were run at a number of different pressures and the results plotted on cross-section paper.

Fig. 1 gives a diagram and Fig. 2 a general view of the testing equipment and shows the blower, testing chamber and discharge pipe and the board on which the gauges are mounted. Fig. 3 shows the method of placing the windows to be tested in the chamber, the chamber being swung open on its hinges.

The general method of testing is to determine (1) the total leakage for the window as delivered by the manufac-

chiefly the sash perimeter leakage, the architects have also called the curve showing this leakage the "100% strip;" that is, the curve would show the leakage of a window if the weather stripping is 100% efficient. Weather stripping will reduce the "elsewhere leakage," to some extent, particularly if the upper sash is stripped on weather side, so as to prevent air from entering the pulley holes in the frame.

Fig. 4, shows the results of a test on a hollow-metal window "C" and gives the leakage in cubic feet per minute on the horizontal scale for varying differential pressures indicated in the vertical scale. Test No. 13 is with the window as manufactured and locked Test No. 19 gives the test of the same window after a well-known make of weather strip had been applied. At a differential pressure of 1 in. the leakage was reduced from 134 cu. ft. to 96 cu. ft. or about 28% only. The window was then fitted with an inside wooden casement and the result given in Test No. 18a was obtained. The cracks

in the sash were then puttied up and the so-called "elsewhere leakage" was obtained and this is given in Test No. 21. Fig. 5 gives the results of tests on hollow-metal window "H." Test 38 and 47 were with the window plain. Tests 37 and 45 were made after weather stripping was applied.

Fig. 6 shows the summary of the principal results of most of the tests and gives the total leakage for the various windows tested. Fig. 7 gives the leakage through the perimeter of the sash only. In both cases the leakage is reduced to cubic feet per minute per linear foot of sash perimeter. Referring to Fig. 6 the poorest result is with a hollow-metal window plain, that is, without weather strips. Test A-5 is upon the same window fitted with a well-known make of weather strip. Test G-34 is an ordinary wooden window without weather strips and Test G-36 is the same window equipped with a well-known make of weather strip. Particular attention is called to this test as it represents in all probability about the leakage, perhaps a little less than most formulas for calculating radiating surfaces are intended to take care of. Most of the tests are of hollow-metal windows. Test No. D-24 is a metal-covered wooden window without weather strips. Test No. I-51 is for a patented pivoted window built of solid steel sections in which the leakage was found to be almost negligible and test L-56 is upon another make of pivoted window of solid sections where the leakage proved to be excessive.

An examination of the curves in Fig. 6 will show that at a differential pressure of 1 in. of water the leakage through some of the hollow-metal windows amounted to about 10.5 cu. ft. per minute, and 1.2 cu. ft. with the weather-stripped wooden window or nearly nine times as much.

EFFECT OF EXCESSIVE LEAKAGE ON HEATING REQUIREMENTS.

In endeavoring to find out what the excessive leakage meant in ordinary heating practice the author made the following calculation to find out, approximately at least, the leakage permitted by a well-known formula for determining radiating surfaces. The transmission through the north wall of a certain office building with 70° F. inside and zero outside, according to the method used by the late Mr. Alfred R. Wolff, amounted to about 57,000 thermal units per hour and the addition to this for "exposure" amounted to about 20,000 thermal units per hour in

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FIG. 3.—METHOD OF PLACING WINDOW IN TESTING CHAMBER.

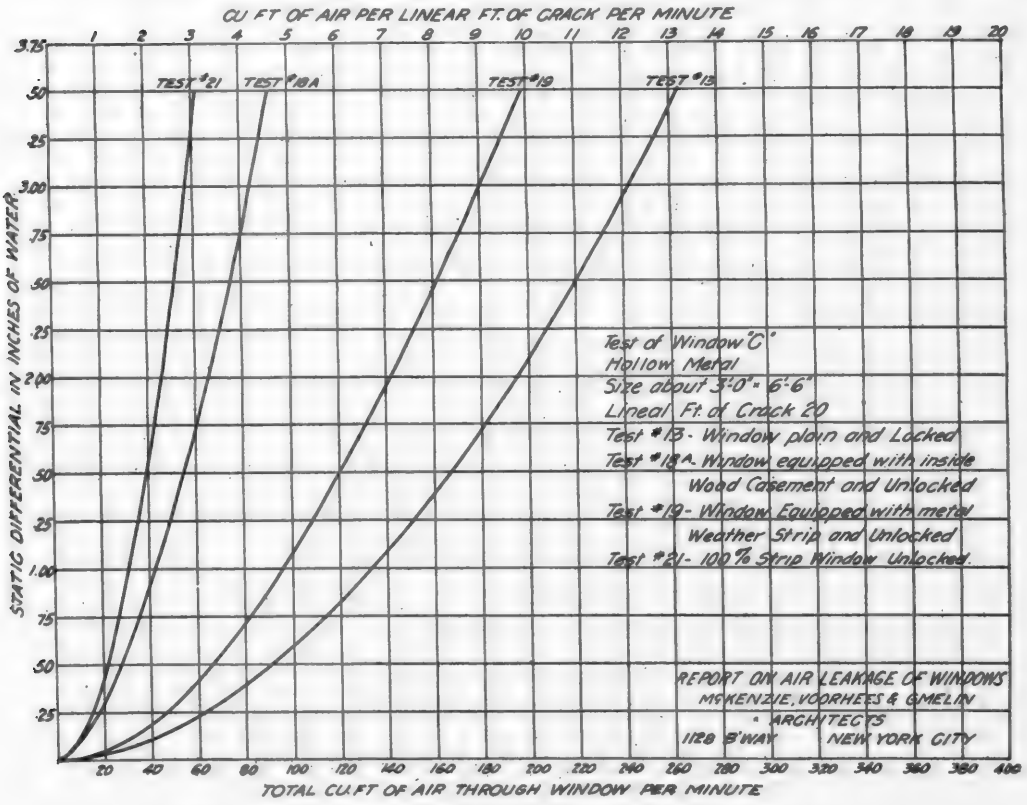

CU FT OF AIR PER LINEAR FT OF CRACK PER MINUTE
STATIC DIFFERENTIAL IN INCHES OF WATER
TEST #21
TEST #18A
TEST #19
TEST #13
Test of Window "C"
Hollow Metal
Size about 3'-0" × 6'-6"
Lineal Ft. of Crack 20
Test #13 - Window plain and Locked
Test #18A - Window equipped with inside Wood Casement and Unlocked
Test #19 - Window Equipped with metal Weather Strip and Unlocked
Test #21 - 100% Strip Window Unlocked.
REPORT ON AIR LEAKAGE OF WINDOWS
McKENZIE, VOORHEES & GMELIN
ARCHITECTS
1128 B'WAY NEW YORK CITY
TOTAL CU FT OF AIR THROUGH WINDOW PER MINUTE

FIG. 4.—TEST ON A HOLLOW-METAL WINDOW, TYPE C.

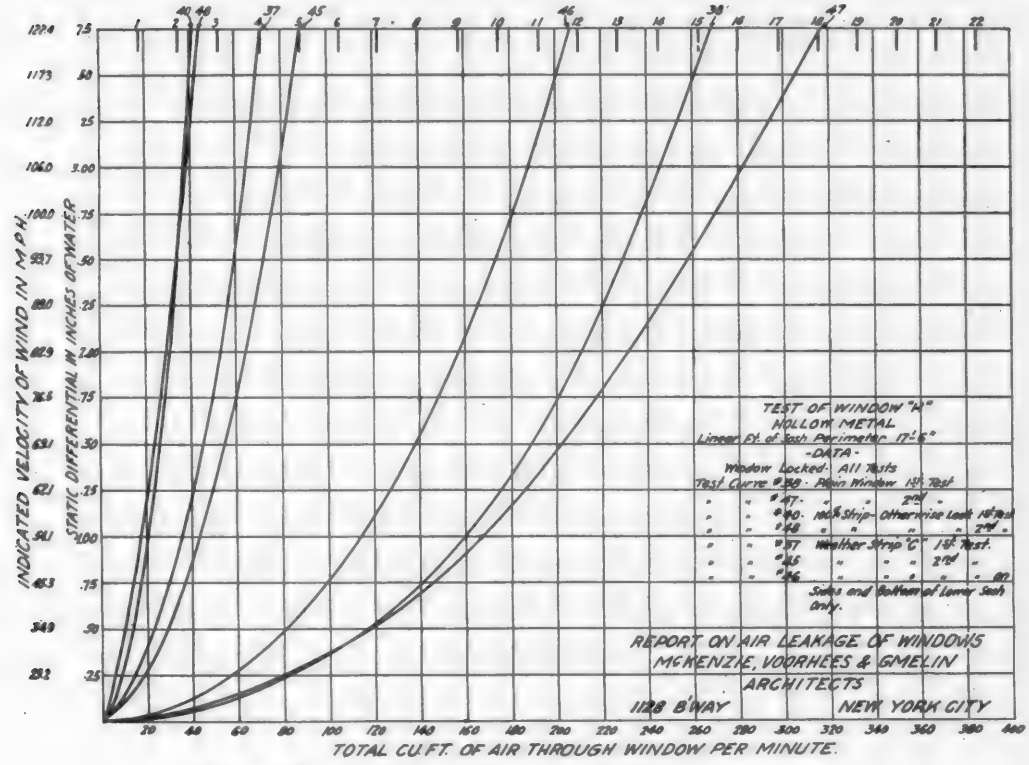
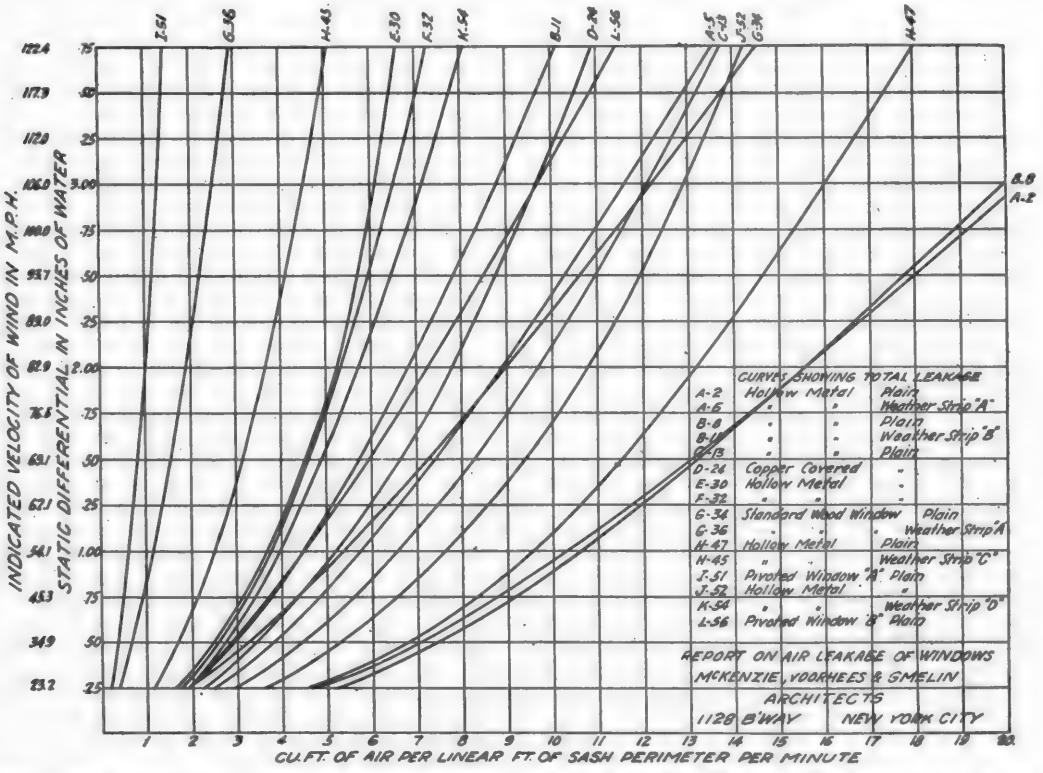

INDICATED VELOCITY OF WIND IN M.P.H.
STATIC DIFFERENTIAL IN INCHES OF WATER
TEST OF WINDOW "H"
HOLLOW METAL
Lineal Ft. of Sash Perimeter 17'-6"
-DATA-
Window Locked - All Tests
Test Curve #39 - Plain Window 1st Test
Test #47 - " " 2nd "
Test #40 - 100% Strip - Otherwise Leak 1st Test
Test #48 - " " " 2nd "
Test #37 - Weather Strip "C" 1st Test.
Test #45 - " " " 2nd "
Test #46 - " " " " "
Sides and Bottom of Lower Sash Only.
REPORT ON AIR LEAKAGE OF WINDOWS
McKENZIE, VOORHEES & GMELIN
ARCHITECTS
1128 B'WAY NEW YORK CITY
TOTAL CU FT OF AIR THROUGH WINDOW PER MINUTE.

FIG. 5.—TEST ON HOLLOW-METAL WINDOW, TYPE H.


INDICATED VELOCITY OF WIND IN M.P.H.
STATIC DIFFERENTIAL IN INCHES OF WATER
CU. FT. OF AIR PER LINEAR FT. OF SASH PERIMETER PER MINUTE
CURVES SHOWING TOTAL LEAKAGE
A-2 Hollow Metal Plain
A-5 " " Weather Strip "A"
B-8 " " Plain
B-11 " " Weather Strip "B"
C-13 " " Plain
D-24 Copper Covered "
E-30 Hollow Metal "
F-32 " "
G-34 Standard Wood Window Plain
G-36 " " Weather Strip "A"
H-47 Hollow Metal Plain
H-45 " " Weather Strip "C"
I-51 Pivoted Window "A" Plain
J-52 Hollow Metal "
K-54 " " Weather Strip "D"
L-56 Pivoted Window "B" Plain
REPORT ON AIR LEAKAGE OF WINDOWS
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ARCHITECTS
1128 B'WAY NEW YORK CITY

FIG. 6.—SUMMARY OF PRINCIPAL RESULTS OF TESTS, WITH TOTAL LEAKAGE FOR VARIOUS WINDOWS TESTED..

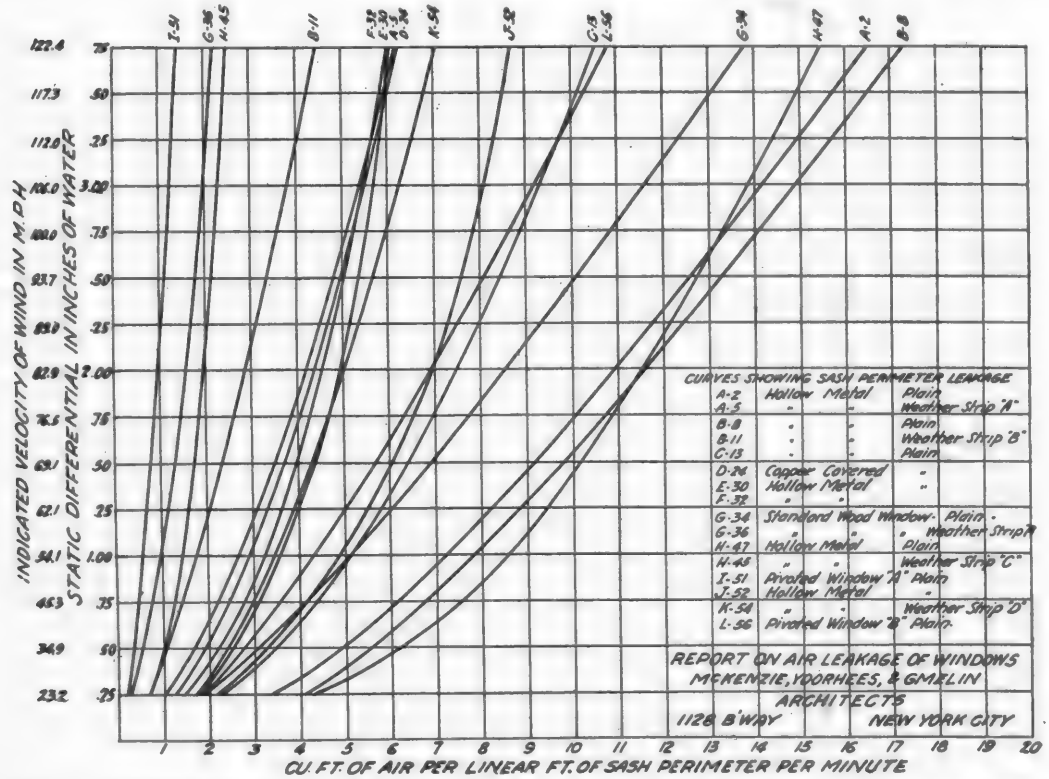
INDICATED VELOCITY OF WIND IN M.P.H.
STATIC DIFFERENTIAL IN INCHES OF WATER
CU. FT. OF AIR PER LINEAR FT. OF SASH PERIMETER PER MINUTE
CURVES SHOWING SASH PERIMETER LEAKAGE
A-2 Hollow Metal Plain
A-5 " " Weather Strip "A"
B-8 " " Plain
B-11 " " Weather Strip "B"
C-13 " " Plain
D-24 Copper Covered "
E-30 Hollow Metal "
F-32 " "
G-34 Standard Wood Window Plain
G-36 " " Weather Strip "A"
H-47 Hollow Metal Plain
H-45 " " Weather Strip "C"
I-51 Pivoted Window "A" Plain
J-52 Hollow Metal "
K-54 " " Weather Strip "D"
L-56 Pivoted Window "B" Plain
REPORT ON AIR LEAKAGE OF WINDOWS
McKENZIE, VOORHEES, & GMELIN
ARCHITECTS
1128 B'WAY NEW YORK CITY

FIG. 7.—RESULTS OF TESTS FOR AIR LEAKAGE THROUGH PERIMETER OF SASH ONLY.

addition, the latter being added according to the author's understanding of Mr. Wolff's rule, to warm the inleaking air to room temperature. Now the perimeter of the windows in the north wall of this floor amounted to 400 lin. ft., hence we have:

$$\text{B. T. U per hour} = \text{Per. in ft.} \times \text{c.f.m. per ft.} \times \frac{70}{55} \times 60.$$

$$\text{C.f.m. per ft.} = \frac{20{,}000 \times 55}{60 \times 70 \times 400}$$

$$\text{C.f.m. per ft.} = 0.65.$$

WHY SOME OF THE EXCESSIVE LEAKAGE WOULD NOT OCCUR IN PRACTICE.

A comparison of this apparent permissible leakage with what actually occurred in the tests shows immediately that the excessive leakage found in some of the tests cannot obtain in practice and the reason for this is, of course, apparent. The tests covered the leakage with certain differences of pressure. It is difficult for this to occur in practice first because of the oblique angle at which a wind ususally strikes a building, and what is of greater moment the improbability of maintaining any great differences of pressure on both sides of window as they are usually employed in buildings. If a window forms part of the exposed side of a closed room, for instance, just as soon as leakage begins to occur due to outside wind pressure, the pressure begins to build up inside of the room and so reduces the differential pressure that causes the leakage.

While attention is drawn to the fact that the leakage as shown in the test cannot be reached in practice in so far as actual air movement is concerned, it is believed that the relation between the actual leakages of windows of different types is in the same proportion as in the tests noted. If, therefore, certain windows are apt to leak under severe outside weather conditions several times as much as a window that is reasonably tight, the matter at once becomes of vital importance to the heating engineer

With a variation in the possible window leakage such that the radiating surfaces required may be any amount from the normal to several times the normal surface required with reasonably tight windows the method of the heating engineer must become a matter of guess-work rather than the application of rules that have become more or less of an exact science. This matter is of far greater importance to the owner, however than it is to the heating engineer for he has to pay for the privilege of using leaky windows, the greater cost of the heating system and the greater fuel cost after the building is in use. Furthermore, the occupants of buildings so equipped have to endure the discomfort brought about by the excessive overheating in mild weather and in light winds brought about by the large amount of radiating surfaces required under extreme conditions.

What the architects who made the test are endeavoring to establish, is a comparative value or leakage factor for various types and makes of windows and to establish a standard of permissible leakage. It is to be hoped that the presentation of the data so far obtained will awaken an interest in the minds of heating engineers as to the importance of the subject, and will cause them to do what they can to create the demand for tighter and more serviceable windows.

Requirements for Model Compulsory Heating and Ventilation Laws

MINIMUM PROVISIONS FOR PUBLIC AND SEMI-PUBLIC BUILDINGS PROMULGATED BY THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

We take pleasure in presenting herewith the full text of the minimum heating and ventilation requirements which have been officially recommended for legislation by The American Society of Heating and Ventilating Engineers. The final draft of these requirements, as here presented, was completed by the council of the society recently and followed several preliminary reports dating from January, 1914, when the original committee was appointed to draft the necessary requirements.

The code now goes forth with the sanction of the society and is intended for use throughout the country in drafting compulsory ventilation laws, as well as in guiding the public generally in regard to the proper air conditions to be obtained in various classes of buildings.

Emphasis is laid on the point that the requirements as given are not intended to be the last word on the subject but as something tangible and definite and in line with the latest practice. As further progress is made, it is the intention of the society to develop the requirements still further.

Report of the committee appointed January, 1914, to prepare a set of minimum ventilation requirements for public and semi-public buildings which the society can can recommend for legislation.

GENERAL STATEMENT.

A correct interpretation of the experimental work which has been carried on, relating to ventilation practice, forces certain conclusions:

A. The necessity for adequate ventilation has been emphasized although the relative importance of certain factors has changed.

B. A high temperature, especially if associated with a high relative humidity, is injurious.

C. The proper relation between air temperature and relative humidity should be emphasized.

D. Air movement in contact with the body materially assists normal heat dissipation.

E. Air supply free from dust, bacteria and other contaminations is important.

We believe that the importance of the following requirements has been amply demonstrated:

1. A minimum allotment per person of floor and air space based upon the nature of occupancy.
2. A quantitative minimum air supply requirement.
3. A carbon dioxide test for determining the quantity of air supply and its distribution.
4. A temperature range limitation.
5. The removal from the air of injurious substances arising from manufacturing processes or other causes.
6. Air exhaust requirements for special service rooms (toilets, locker rooms, etc.).
7. Definite requirements regarding the drawing, filing and approving plans for both new and existing buildings, in which ventilating equipments are to be installed or changes in the equipment made.
8. Ample authority to enforce the law without recourse to civil action, and with sufficient operative and financial assistance to care for the clerical, field and technical details incurred by such enforcement.
9. The official body charged with the enforcement of such laws shall have authority to promulgate specific rules and regulations covering details of installation and operation not included in the law. Such rules and regulations must not conflict with the full intent and meaning of the law.

Your committee has decided that it would be impractical to attempt to draft a model ventilation law for reasons herein given, and because this would require an extensive building classification which could not be satisfactorily used in the various states, cities or towns where building laws and regulations, based on other classifications, are now in force. The committee submits herewith first (under Section I) the specific report covering general suggestions for minimum heating and ventilation requirements that are applicable to all classes of buildings, and second (under Sections II, III and IV) separate sets of more definite requirements for schools and colleges, factories and theaters.

Sections II, III and IV cover three very important classes of buildings, which are often the subject of separate legislation. Many other classes of buildings, such as Department Stores, Hospitals and similar institutions, Churches, Restaurants, Police Station, Jails, Bakeries, Laundries, etc., for which the requirements for heating and ventilation are covered by careful interpretation and use of Section I, would be benefited by separate sets of requirements. It is apparent also that suggestions from our society, covering practical requirements for the heating and ventilation of street cars and certain other public conveyances are desirable. This report could be considerably enlarged to cover these subjects.

The committee strongly urges that educational and co-operative methors of improving heating, ventilation and sanitation conditions be studied and used as far as possible in addition to compulsory methods.

The committee wishes to thank the various members of the society and others who have assisted in any way in the compilation of these recommendations. Whenever asked for, information was cheerfully given when such information was available. Acknowledgments are especially due the investigations and recent committee reports concerning the work in New York City and to the ventilation code and experience in the City of Chicago.

JAMES D. HOFFMAN, Chairman.
E. VERNON HILL.
FRANK T. CHAPMAN.

SECTION I.

General Suggestions for the Compilation of Laws for Compulsory Ventilation.

(Applicable to all Classes of Buildings.)

General: Sufficient and proper heating and ventilation shall be provided and maintained during occupancy in all rooms and all enclosed spaces, in all classes of buildings, to insure reasonable health and comfort conditions and maintain the requirements of Articles I to X inclusive.

Article I—Space Per Occupant (minimum requirement).

Schools and colleges—class, study, lecture and recitation rooms, floor area per occupant in square feet	15
Schools and colleges—class, study, lecture and recitation rooms, cubic space per occupant (volume divided by number of persons) in cubic feet	180

Primary schools—class and study rooms (pupils under 8 years of age), floor area per occupant in square feet..... 12.5
Primary schools—class and study rooms (pupils under 8 years of age), cubic space per occupant in cubic feet..... 150
Theatres, auditoriums and court rooms, floor area per occupant in square feet..... 6
Theatres, auditoriums and court rooms, floor space per occupant in square feet..... 90
Factories, manual training rooms and other work rooms—cubic space per occupant in cubic feet. 250

Minimum space conditions in all clases of buildings or rooms not tabulated shall be reasonable and pratcical and shall meet the approval of the Department of Health.

Article II—Air Supply (minimum requirement).

Sufficient outdoor air shall be provided for all occupied rooms or enclosed spaces at all times during occupancy, as may be necessary to meet the requirements of Articles I to XI, inclusive.

The supply of outdoor air for the following classes of rooms shall be positive and based on a minimum quantity of cubic feet per occupant per hour as tabulated:

Class, study, lecture and recitation rooms in all schools and colleges, cubic feet per occupant per hour..... 1,800
Theatres, court rooms and other auditoriums.. 1,200
Factories, manual training rooms and other work rooms. 1,500

All air supply for ventilation must be from an uncontaminated source or air from which the dust or other impurities shall be sufficiently removed by washing, or otherwise, subject to the approval of the Department of Health.

Article III—Air Distribution.

The distribution and temperature of the air supply for ventilation shall be so arranged as to maintain the temperature requirement, as stated in Article IV, without uncomfortable drafts, or any direct draft lower than 60° F., and as a test of proper supply and distribution, it shall be required that the CO_2 content shall not at any time exceed 10 parts in each 10,000 parts of air based upon tests of air samples taken in a zone from 3 to 6 ft. above the floor line in any part of the occupied spaces. This requirement may be modified by the Department of Health or other properly constituted authority as applying to breweries, water charging rooms or other rooms where carbon dioxide is liberated in manufacturing processes.

NOTE. While carbon dioxide in the air, in reasonable quantities, is not considered injurious to health, its presence in occupied rooms is an accurate measure of the air supply and distribution if no other source of carbon dioxide is present except the occupants of the room.

Article IV— Temperatures.

The temperature of the air in occupied rooms in all classes of buildings, during the periods of occupancy, shall be not less than 60° F., nor more than 72° F., except when the outside temperature is sufficiently high that artificial heating in the building is not required. This requirement shall not apply to foundries, boiler or engine rooms, or special rooms in which other temperatures are required or advisable as approved by the Department of Health.

Article V—Heat Sources.

Any heat source which does not contaminate the air and which does not conflict with the requirements of the Health, Fire, Building or Electrical Departments may be used both to warm the air supply for ventilation and to provide heat by direct radiation.

Article VI— Removal of Injurious Substances by Mechanical Exhaust.

Where dust, fumes, gases, vapors, odors, fibres or other impurities are generated or released in the course of a business or process carried on in any work room or other place in quantities tending to injure the health of occupants, there shall be provided canopies, hoods or other special devices, connected with an exhaust fan or fans of sufficient capacity and operated at sufficient pressure to remove such impurities at their point of origin. Such fans shall be kept running constantly while such impurities are being generated or released and shall discharge through ducts or flues to a point above the roof or otherwise and be provided with dust collectors or separators as may be necessary to safeguard the fresh air supply of the building or adjacent buildings and prevent any public nuisance. If practical and positive means, other than mechanical exhaust, can be devised for keeping these impurities from the air, such means may be used when formally approved by the Department of Health.

Article VII—Excessive Temperature and Humidity.

If, owing to the nature of the work done or the process carried on in a work room, factory, or other place of employment or occupancy excessive heat or humidity is caused therein, sufficient to be injurious to health, there shall be provided and maintained special means or appliances to reduce and control such excessive heat and humidity, subject to the approval of the Department of Health.

Article VIII—Special Service Rooms.

Public and semi-public locker rooms, coat rooms, dressing-rooms and wash rooms shall have exhaust ventilation equal to not less than six changes of air per hour, except where the window area opening directly to the outside air equals or exceeds ⅛ of the floor area of the room, subject to the discretion of the Department of Health.

Article IX—Toilet Room Ventilation.

(a)—Installations in New Buildings.

Every toilet room or every water closet or urinal compartment shall be ventilated directly to the outer air by a movable window or by skylight with fixed or pivoted louvres. Every such room or compartment shall have a window or glass skylight not less than one foot wide and of an area of at least six feet square for one water closet or urinal. For every such additional fixture the area of the window or skylight shall be increased by at least one square foot. The Department of Health may require mechanical ventilation in addition to the above requirement where under any special conditions the window ventilation is deemed inadequate. The Department of Health may permit the installation of toilet rooms, water closet or urinal compartments with less window or skylight area than specified in this paragraph above, or without direct connection to the outer air, if a mechanical system of exhaust ventilation is provided, maintained and continually operated. This mechanical system shall consist of metal or smooth masonry ducts from the individual toilet rooms or compartments, to a fan or fans of sufficient capacity to exhaust a volume of not less than 35 cu. ft. of air per minute for each water closet or urinal. If the air is exhausted from within two feet of each fixture this amount may be reduced to 25 cu. ft. of air exhausted per minute per fixture.

(b)—New and Existing Equipments in Old Buildings.

In existing buildings erected prior to the passage of this ordinance every toilet room or water closet or urinal compartment shall be ventilated to the outer air by movable window; glass skylight with fixed or movable louvres, or by ventilating duct. Whenever any such toilet room having more than two fixtures (water closets or urinals) is ventilated soley by ducts, or whenever the window or skylight area is one-third less than the area required for "new buildings" positive ventilation complying with the requirements of subdivision (a) of this Article IX shall be installed and maintained if so ordered by the Department of Health. The Department of Health may, at its discretion, modify this requirement for four or less fixtures, or may require ventilation for two or less fixtures.

(c)—All Installations.

Every window or skylight mentioned in (a) and (b) of this Article shall be so constructed and maitnained as to be easily opened at least one-half of its required area for windows and one-fourth its area for skylights. All exhaust fans used for ventilating toilet rooms shall exhaust to the outer air above the roof or at such points as not to cause offense to the occupants of the building or any other building or to create any public nuisance in the neighborhood.

(d)—Air Shafts.

Whenever any air shaft for ventilating toilet rooms is covered by a skylight the net opening or openings available in such skylight shall be at least equal in area to the cross-sectional area of the shaft requirement.

Article X—Cellars.

All cellars, basements or spaces beneath buildings of any class or character shall be provided

with windows or other adequate means of ventilation and such cellars or spaces shall be at all times properly ventilated and maintained in a dry and sanitary condition.

Article XI—Authorization.

The Department of Health is authorized to require additional or special ventilation or ventilating devices to cover any conditions which are unusual or require special treatment in occupied rooms or spaces in any class of buildings.

Article XII—Plans.

Before beginning the erection or alteration of any building the architect or contractor, owner, agent or party in possession or control, shall submit plans and specifications in duplicate showing and describing in detail the ventilating equipment contemplated. Such plans must be drawn to scale on cloth, in ink or by some process that will not fade or obliterate. The plans shall show accurately all dimensions and details and shall be accompanied by a written statement giving the number of occupants of each room and the use of the room unless the plans clearly indicate these facts. Such plan and specifications must be submitted and approved by the Department of Health before work is allowed to proceed. During the erection or alteration of any such building inspections must be made by persons duly authorized by the Department of Health and after completion a certificate shall be issued which states that the ventilating equipment of such building complies in all respects with the approved plans and specification and with the laws governing the same.

Article XIII—Officials Empowered to Enter.

The Commissioner of Health or his duly authorized assistants shall have the right to enter any building covered by the provisions of the ventilation law, at any reasonable time, and at any time when occupied by the public, in order to examine such building and judge of the condition of the same and to discharge his duties pertaining thereto, and it shall be unlawful for any person or persons to interfere with him in the performance of this duty.

Article XIV—Officials Empowered to Close.

Where it is discovered that any violation of the ventilation law is existing in any building the Commissioner of Health shall give due written notice to correct the same. If after a reasonable period this notice is not complied with the Commissioner of Health shall have the power and it shall be his duty to close and keep closed to the public any such building or part thereof so long as the conditions of violation exist.

NOTE.—It will be observed that the committee has used the term "Department of Health" throughout its report, and while the committee recommends that the enforcement of the laws be entrusted to local health departments in cities and to State Boards of Health in smaller towns it is evident that, in many cases, the enforcement will be vested in other bodies, in which case the proper name of the body authorized should be substituted for the term "Department of Health" used in the recommendations.

SECTION II.

Schools and Colleges.

(Special minimum heating and ventilating requirements applying to all Schools and Colleges. Supplementary to Section I.)

General: Sufficient and proper heating and ventilation shall be provided and maintained during occupancy in all rooms and all enclosed spaces in all classes of school and college buildings to insure health and comfort conditions, as required by the Department of Health.

Article I—Space Per Occupant.

a. A minimum of 15 sq. ft. of floor area and 180 cu. ft. of space per occupant shall be provided in each class, study, lecture, and recitation room, except that a minimum of 12¼ sq. ft. of floor area and 150 cu. ft. of space may be accepted in class and study rooms for pupils under 8 years of age.

b. A minimum of 6 sq. ft. of floor area and 100 cu. ft. of space per occupant shall be provided in auditorium and assembly rooms.

c. Minimum space conditions per occupant in all classes of rooms not tabulated shall be reasonable and practical and shall meet the approval of the Department of Health.

Article II—Air Supply Per Occupant.

Sufficient outdoor air shall be provided for all occupied rooms at all times during occupancy as may be necessary to meet the requirement of Articles II to VII, inclusive.

A positive supply of outdoor air shall, while school is in session, be provided the following rooms and the quantity of this positive air supply shall be equal to, or be in excess of, the following minimum requirements per occupant per hour:

Class, study and recitation rooms.....1,800 cu. ft.
Auditoriums, assembly rooms and libraries. .....1,200 cu. ft
General and chemical laboratories.....1,800 cu. ft.
Domestic science and manual training rooms. .....1,800 cu. ft.

Offices, reception rooms, libraries, teachers' rooms, retiring rooms, play rooms, corridors, gymnasiums and lunch rooms, shall be provided with approved ventilation, and the ventilation of gymnasiums shall be based upon a minimum of four changes of air in the room per hour, excepting in specific cases, where the Department of Health may have the power to modify this requirement.

The air supply for ventilation shall be taken from an uncontaminated source, or the air supplied must be air from which the dust or other impurities shall be sufficiently removed by washing, filtering or other approved method.

Article III—Air Distribution.

The distribution and temperature of the air supply for ventilation shall be so arranged as to maintain the temperature requirement of the following Article IV, without uncomfortable drafts or any drafts lower than 60° F., and as a test proper air supply and distribution, it shall be required that the CO_2 content shall not be alowed to exceed 9 parts in each 10,000 parts of air, based upon tests taken in a zone from 3 to 6 ft. above the floor line in the occupied spaces.

Article IV—Temperature.

The tempearture of the air in the various rooms and spaces within the building during the period of occupancy shall be maintained at all times throughout all occupied spaces within the ranges given in the following schedule, except when the outside temperature is sufficiently high that artificial heating in the building is not required:

Class, study, lecture and recitation rooms .....66° to 67° F.
Auditoriums and assembly rooms.....64° to 68° F.
General laboratories, domestic science and manual training rooms.....62° to 68° F.
Gymnasiums .....55° to 65° F.
Offices, reception rooms, teachers' rooms, retiring rooms.....65° to 70° F.
Corridors. .....60° to 70° F.
Play rooms, lunch rooms, locker rooms, wash rooms, dressing-rooms and coat rooms .....60° to 68° F.
Toilet rooms.....55° to 68° F.

For rooms not named the temperature range shall be 60° to 70° F. according to use.

The article shall not apply to outdoor school rooms termed "open air" school rooms. An accurate thermometer shall be provided and remain set and maintained at a height of 5 ft. from the floor against an inside wall of each class, recitation, study or lecture room. One such thermometer shall be placed and maintained in each laboratory, domestic science, and manual training room and at least two such thermometers in each auditorium, assembly room and gymnasium. Provide proper insulation between thermometer and wall.

Article V—Special Exhaust Ventilation.

There shall be provided for all laboratories, domestic science rooms or other rooms where gases, fumes or other special impurities are released in quantities tending to injure the health of the occupants, suction devices that shall remove such gases, fumes and other impurities from said laboartories, domestic science rooms or other rooms at or near the point of origin. Where the Department of Health shall deem it necessary proper hoods and ducts connected with exhaust fan or fans of sufficient capacity, and operating at sufficient pressure shall be provided to remove such impurities. Said fan or fans shall be kept running constantly while such impurities are being generated or released and shall discharge at a point above the roof or otherwise as may be necessary to safeguard the fresh air supply for the building from contamination and prevent any public nuisance.

Article VI—Special Service Rooms.

General locker rooms, coat rooms, dressing-rooms and wash rooms shall have exhaust ventilation equal to not less than 6 changes of air per hour except where windows of such rooms open directly to the outside air are at least equal in area to one-eighth of the floor area of the room. In such cases the exhaust ventilation requirement may be modified under discretion of the Department of Health.

Article VII—Toilet Room Ventilation.

See Toilet Room Ventilation, Section I, Article IX.

Article VIII—Heat Sources.

Any heat source which does not contaminate the air and which does not conflict with the requirements of the Health, Fire, Building or Electrical Departments may be used both to warm the air supply for ventilation and to provide heat by direct radiation.

Article IX—Temperature Control.

Temperature control, preferably of an automatic type, is required for all heated and ventilated rooms. The temperature regulation, whether by automatic or hand control, shall be so arranged that its operation will not decrease the required volume of air supply for ventilation.

Article X—Moving Picture Machines.

Where facilities are given for moving picture machines, all ventilation and fire protection shall conform to Section IV, Article VI, and accompanying suggestions.

Article XI—Gravity Indirect Systems.

Gravity indirect heating and ventilating systems of approved design meeting the general requirements of this section II may be accepted for small school houses not exceeding eight class rooms in localities where proper motive power for positive mechanical ventilation is lacking, provided such gravity systems shall, with room tempeartures maintained at 70° F. and a difference of 40° F. between the temperature of the outside air and that of the air entering the room at the warm air inlet, be capable of supplying at least 30 cu. ft. of air per minute for each pupil accommodated in the room or rooms.

GENERAL SUGGESTIONS FOR SCHOOLS AND COLLEGES.

General questions, such as inspection, method of enforcing the requirements, penalties for non-compliance, etc., are left largely for each state, city or town to determine, although some pertinent suggestions covering these matters are made in Section I, Articles XI, XII, XIII and XIV. *Inspection, method of enforcing and penalties are vitally important and should have careful consideration.*

It should be especially noted that the foregoing regulations call for a minimum of all requirements as compulsory, and that it should be the aim of the administrative department having enforcement of the regulations in charge, to encourage the installation of liberal and high-class equipment in our schools for the public inspiration as well as for the health and comfort of the occupants.

In Article I, minimum floor space and volumes for laboratories, manual training and domestic science rooms were omitted because of the wide diversity of existing practice. Values which seem reasonable are:

Floor space, per occupant, 25 sq. ft.; volume, per occupant, 300 cu. ft.

In Article II, "air from an uncontaminated source" comprehends a supply of air, either normally pure as it enters the building or purified by some approved method before being distributed to the rooms in the building.

Elimination of dust from the air supply by means of air filters or air washers is desirable even under the best conditions and is absolutely imperative under some conditions of especially dusty air supply.

The controlling of relative humidity, within the range of 35 per cent. to 50 per cent. is desirable, wherever possible.

Rules for opening class room windows, under proper supervision, during recess periods are often valuable.

Strong emphasis is placed on the need of having the administrative feature of legislation, of the kind here advocated, placed in the control of a responsible department, such as a State Department of Health in the case of villages, and a Municipal Department of Health or some other responsible municipal department for cities. It is further urged that such department be supplied with a special inspector or inspectors, experienced in heating, ventilation and sanitation, and that such department be given reasonable latitude by legislation to require approval of plans preceding installation; to require special extra equipment for special cases, such as dust filters or air washers for air supply where the same is especially dust laden; to require fans in the auditorium to keep the air in motion where air distribution is deficient, etc., it being made clear in the legislation that such latitude should in no case include the right to reduce the general legal ventilation requirements.

The Committee recommends that the clauses relating to the power of entry and closure by authorized officers as stated in Section I, Articles XIII and XIV of this report (which have been of great benefit in the City of Chicago), or clauses to the same effect, be included in every ventilation law.

SECTION III.
Factories.

(Special Minimum Heating and Ventilation Requirements Applying to all Classes of Factories and Work Rooms. Supplementary to Section 1).

Definition.

Any building or room where persons are at work or employed in the manufacture, assembling or repairing of goods or materials which are not for their own family consumption or personal use shall be deemed a "factory" for the purposes of this Section.

General Requirement.

The owner or lessee or tenant or agent of a building used as a factory or in which a factory work room or work rooms are located, or the owner or lessee or tenant or agent of any work room in any building used for factory purposes, shall provide and maintain for every work room thereof and for all allied service rooms in connection therewith (such as office, stock, sorting, shipping, wash, dressing, locker and toilet rooms) good and sufficient ventilation and healthful temperature and humidity conditions at all times during working hours.

Article I— Space Per Occupant.

A minimum space of 250 cu. ft. per occupant shall be provided in all work rooms and no work room, of which occupancy is taken after the date of issuance of this provision, shall have less than a clear height of 10 ft.

Article II—Air Supply Per Occupant.

A positive supply of outdoor air from an uncontaminated source shall be provided the work room at all times during working hours, and the quantity of this positive supply of outdoor air shall be based upon a minimum requirement of 1,500 cu. ft. per hour per occupant introduced in such a manner as to fully meet the requirements of Articles III and IV.

Where the space per occupant is less than 1,000 cu. ft., or the window area, opening directly to out of doors, is less than 8 sq. ft. per occupant, a positive air supply shall be furnished by mechanical or other means.

Article III—Air Distribution.

The distribution of the fresh air supplied shall be so arranged as to maintain the temperature requirement without uncomfortable drafts, or any draft lower than 60° F. in occupied spaces. (See exceptions under the following Article No. IV.) One test of proper air supply and distribution will be that the CO_2 content in any occupied part of a work room shall not at any time exceed 10 parts in 10,000 parts of air, based upon tests of air taken in a zone of 3 ft. to 6 ft. above the floor line in any part of the occupied spaces. (See exceptions in Section I, Art. III.)

Article IV—Temperature.

The temperature of the air in the work room shall, at all times during working hours, be maintained throughout the actual working spaces, within the range of 60° F., to 72° F., depending upon the class of work and workers—except when the outside temperature is sufficiently high that artificial heating in the building is not required or when the particular class of work requires or makes advisable other temperatures that may be approved by the Department of Health.

The temperature of the air in offices shall be maintained during occupancy within the range of 65° to 70° F.; in wash, dressing and locker rooms during working hours, 60° to 70° F.; and in toilet rooms 55° to 68° F.

Accurate thermometers shall be provided, set and maintained at a height of 5 ft. from the floor of

all work rooms, at least one thermometer for every 2,000 sq. ft. of floor area. Provide proper insulation between thermometer and wall.

Article V—Heat Sources.

Any heat source which does not contaminate the air and which does not conflict with requirements of the Health, Fire, Building or Electrical Departments, may be used both to warm the outdoor air supply and to provide heat by direct radiation.

Article VI—Special Service Rooms.

Locker, wash, dressing and coat rooms shall be ventilated in a manner approved by the Department of Health. See Section I, Article VIII.

Article VII—Removal of Injurious Substances by Mechanical Exhaust, or Other Practical or Positive Means.

Where dust, fumes, gases, vapors, odors, fibres or other impurities are generated or released in the course of a business or process carried on in any work room or other place in quantities tending to injure the health of the occupants, there shall be provided canopies, hoods or other special devices, connected with exhaust fan or fans of sufficient capacity and operated at sufficient pressure to remove such impurities at their point of origin. Such fans shall be kept running constantly while impurities are being generated or released, and shall discharge at a point above the roof or otherwise if so directed by the Department of Health and be provided with dust collectors or separators as may be required to safeguard the fresh air supply of the building or adjacent buildings and prevent nuisance in the neighborhood. If practical or positive means, other than mechanical exhaust, can be devised for keeping these impurities from the air, such means may be used when formally approved by the Department of Health.

Whenever the amount of air exhausted by suction devices to meet the above requirements exceeds the amount of air supply required for ventilation, the air supply for ventilation shall be increased sufficiently to prevent undue air in-leakage.

Article VIII—Excessive Temperature and Humidity.

If, owing to the nature of the work done or the process carried on in a work room or any occupied space in any factory, excessive heat or humidity is caused therein, sufficient to be injurious to health, there shall be provided and maintained special means or appliances to reduce and control such excessive heat according to the requirements of Article IV, and the relative humidity shall not be permitted to exceed 65 per cent. except when outside weather conditions prevent or when said rooms are used for special purposes which, according to the Department of Health require or make advisable other humidities.

Article IX—Filters and Air Washers.

If in the opinion of the Department of Health the air supply to any building is deemed impure or especially dust laden, filters, air washers or other appliances, satisfactory to the Department, must be provided.

Article X—Air Contamination from Gas Burners.

Where artificial or natural gas is burned in any occupied work room, it shall be the duty of the Department of Health to inspect, and said Department may require special or additional ventilation to overcome any objectionable condition.

Article XI—Toilet Room Ventilation.

See Toilet Room Ventilation, Sec. I, Article IX of the general heating and ventilating requirements.

GENERAL SUGGESTIONS FOR FACTORIES.

General questions, such as inspection, method of enforcing the requirements, penalties for non-compliance, etc., are left largely for each state, city or town to determine, although some pertinent suggestions covering these matters are made in Section I, Articles XI, XII, XIII and XIV. *Inspection, method of enforcing and penalties are vitally important and should have careful consideration.*

It should be especially noted that the foregoing regulations call for a minimum of all requirements as compulsory, and that it should be the aim of the administrative department having enforcement of the regulations in charge to encourage the owners and operators of said factories to provide as comprehensive, liberal and high-class equipment as possible, with a view to catering to the comfort, health and efficiency of the employees.

Elimination of dust from the air supply by means of air filters or air washers is desirable under the best conditions, and is absolutely imperative under some conditions of especially dusty air supply.

The controlling of relative humidity, within the range of 35 per cent. to 50 per cent. is desirable, wherever possible.

Rules for airing all work rooms during the noon hour by means of open windows is, under proper supervision, often valuable.

Strong emphasis is placed on the need of having the administrative features of legislation, of the kind here advocated, placed in the control of a responsible department, such as a State Department of Health in the case of villages, and a Municipal Department of Health or some other responsible municipal department for cities. It is further urged that such department be supplied with a special inspector or inspectors, experienced in heating, ventilation and sanitation, and that such department be given reasonable latitude by legislation to establish rulings within the law requiring approval of plans preceding installation; to require special extra equipment for special cases, such as dust filters or air washers, for air supply where the same is especially dust laden; to require fans in special places to keep the air in motion where air distribution is deficient, etc., it being made clear in the legislation that such latitude should in no case include the right to reduce the general legal ventilation requirements.

Definite penalties, such as fines for minor offenses, up to a closing of the establishment for important or repeated violations, are certainly indispensable to get practical results.

The Committee recommends that the clauses relating to the power of entry and closure by authorized officers as stated in Section I, Articles XIII and XIV of this report (which have been of great benefit in the City of Chicago), or clauses to the same effect be included in every ventilation law.

SECTION IV.

Theatres.

(Special Minimum Requirements Applying to all Classes of Theatres and Motion picture Houses. Supplementary to Section I).

Article I— Space Per Occupant (new places).

a. A minimum of $4^3/_5$ sq. ft. (must be at least 33 in. back to back of seats by at least 20 in. width of seat) of floor area as a seating space per occupant, exclusive of aisles and public passageways, shall be provided in the audience hall.

b. A minimum of 90 cu. ft. of air space, per occupant, shall be provided in the audience hall.

c. Aisles shall have in the aggregate a width of not less than 20 in. for each 100 seating capacity, and for fractional parts of 100, a proportionate part of 20 in. shall be added. No aisles shall have a width of less than 30 in.

Article I-A—Space Per Occupant (existing places).

a. A minimum of $4^1/_3$ sq. ft. (preferably 32 in. back to back of seats by 19½ in. width of seat) of floor area as a seating space per occupant, exclusive of aisles and public passageways, shall be provided in the audience hall.

b. A minimum of 80 cu. ft. of air space, per occupant, shall be provided in the audience hall.

c. Aisles shall have in the aggregate a width of not less than 20 in. for each 100 seating capacity, and for fractional parts of 100, a proportionate part of 20 in. shall be added. No aisles shall have a width of less than 30 in.

Article II—Air Supply Per Occupant (new places).

A positive supply of outdoor air from an uncontaminated source shall be provided the audience hall at all times while the show place is open to the public, and the quantity of this positive supply of outdoor air shall be based upon a minimum requirement of 1,200 cu. ft. per hour per occupant.

Article II-A— Air Supply Per Occupant (existing places).

A positive supply of outdoor air from an uncontaminated source shall be provided the audience hall at all times while the show place is open to the public, and the quantity of this positive supply of outdoor air shall be based upon a minimum requirement of 1,000 cu. ft. per hour per occupant.

Article III—Air Distribution (new places).

The distribution of the supplied outdoor air in the audience hall shall be so arranged as to maintain the temperature requirement without uncomfortable drafts, or any draft lower than 60° F., and as a test of proper supply and distribution, it shall be required that the CO_2 content in any part of such audience hall shall not at any time exceed 10

parts in each 10,000 parts of air, based upon tests taken in a zone from 3 ft. to 6 ft. above the floor line in the occupied space.

Article III-A—Air Distribution (existing places).

The distribution of the supplied outdoor air in the audience hall shall be so arranged as to maintain the temperature requirement without uncomfortable drafts, or any draft lower than 60° F., and as a test of proper supply and distribution, it shall be required that the CO_2 content in any part of such audience hall shall not at any time exceed 12 parts in each 10,000 parts of air, based upon tests of air taken in a zone from 3 ft. to 6 ft. above the floor line in the occupied spaces.

Article IV— Temperatures (both new and existing places)

The temperature of the air in the audience hall during period of occupancy shall be maintained at all times throughout all occupied spaces within the range of 62° F. to 70° F., except when the outside temperature is sufficiently high that artificial heating in the building is not required.

The temperature of the air in dressing-rooms, smoking-rooms, stage, ante-rooms, ticket offices, toilets and any occupied spaces other than the auditorium, shall be maintained as the special use thereof makes desirable within the range covered by Section I, of the general ventilation requirements.

Article V—Heat Sources (both new and existing places).

Any heat source which does not contaminate the air and which does not conflict with the requirements of the Health, Fire, Building or Electrical Departments may be used both to warm the outdoor air supply and to provide heat by direct radiation.

All stoves are prohibited and all gas heaters except when furnished with ample protection and adequate means for the removal of products of combustion are prohibited.

Article VI—Machine Booth Ventilation (both new and existing places).

Enclosures or booths for the motion picture machines shall be provided with exhaust ventilation having sufficient capacity to remove at all times not less than 60 cu. ft. of air per minute through a one-machine booth, not less than 90 cu. ft. of air per minute through a two-machine booth, and not less than 120 cu. ft. of air per minute through a three-machine booth. See Suggestions for theatres for further details.

Where picture machines, films and their equipment are passed as fireproof by the National Board of Fire Underwriters, the Department of Health may, at its discretion, modify the booth requirements.

Article VII—Air Exhaust System.

Attention is called to the general ventilation requirements for Special Service Rooms, Section I, Article VIII.

Article VIII—Toilet Room Ventilation (both new and existing).

See Toilet Room Ventilation, Section 1, Article IX.

GENERAL SUGGESTIONS FOR THEATRES.

General questions, such as inspection, method of enforcing the requirements, penalties for non-compliance, etc., are left largely for each state, city or town to determine, although some pertinent suggestions covering these matters are made in Sec. I, Arts. XI. XII, XIII and XIV. *Inspection, method of enforcing and penalties are vitally important and should have careful consideration.*

It should be especially noted that the foregoing regulations call for a minimum of all requirements is compulsory, and that it should be the aim of the administrative department having enforcement of the regulations in charge, to encourage the owners and managers of motion-picture shows to provide as comprehensive, liberal and high-class equipment as possible, with a view to catering to the comfort and health of the patrons and thus add to the popularity of the show place as compared with others which have barely come within the legal requirements.

The 80 cu. ft. of air space per occupant, allowed by the recommended regulations for "existing places" has been arrived at as an extreme minimum cubic space which should be allowed per individual when considering difficult cases of old established places. Ninety cu. ft. of air space per occupant is considered minimum for "new places."

A mechanical system of exhaust ventilation is desirable for the auditorium of a theatre in addition to the air supply system, but a mechanical system of exhaust ventilation is not made compulsory except where it may be necessary to meet the temperature and air distribution requirements.

The requirement for machine booth ventilation may be fulfilled by having a number of small metal screened openings (equipped with special dampers and automatic appliances with fusible link to automatically close tight in case of fire in the booth) on the sides of the booth near the bottom, aggregating 180 sq. in. for a one machine booth, 210 sq. in. for a two-machine booth, and 240 sq. in. for a three-machine booth, and a metal or other fireproof flue extending from the top or the side near the top of the booth and carried to a proper place of discharge outdoors. The size of this special fireproof vent flue shall be not less than 95 sq. in. clear area for a one-machine booth, not less than 120 sq. in. clear area for a two-machine booth, and not less than 144 sq. in. clear area for a three-machine booth, and in addition it shall be provided with an adjustable damper, operated from the booth and equipped with an appliance containing a fusible link or other device to operate so as to automatically open the damper wide in case of fire in the booth. Provide a metal duct equal in size to the special exhaust duct referred to for the different sizes of booths and connecting from out-of-doors to the bottom or lower part of booth for the introduction of out-door air directly to the booth. This duct shall pitch from the booth downward to the outside wall of the building, shall be provided at the inlet with proper louvres or weather protection hood, and shall have an adjustable damper near the booth, said damper to be controlled from within the booth and to be independently equipped with an appliance containing a fusible link or other device to operate so as to automatically close in case of fire in the booth. The machine booth ventilation shall be kept in operation at all times when the booth is in use.

Where picture machines, films and their equipment are passed as fireproof by the National Board of Fire Underwriters, the Department of Health may, at its discretion, modify the booth requirements.

Elimination of dust from the air supply by means of air filters or air washers is desirable even under the best conditions and is absolutely imperative under some conditions of especially dusty air supply. This question is dealt with by suggestion in the following general clauses.

The controlling of relative humidity, within the range of 35 to 50 per cent. is desirable, wherever possible, but the committee decided to omit from the regulations any humidity requirement in theatres.

Strong emphasis is placed on the need of having the administrative feature of legislation, of the kind here advocated, placed in the control of a responsible department, such as a State Department of Health in the case of villages, and a Municipal Department of Health or some other responsible municipal department for cities. It is further urged that such department be supplied with a special inspector or inspectors, experienced in heating, ventilation and sanitation, and that such department be given reasonable latitude by legislation to require approval of plans preceding installation; to require special extra equipment for special cases, such as dust filters or air washes for air supply where the same is especially dust laden; to require fans in the auditorium to keep the air in motion where air distribution is deficient, etc., it being made clear in the legislation that such latitude should in no case include the right to reduce the general legal ventilation requirements.

Definite penalties, such as fines for minor offenses, up to a suspension or revoking of licenses for important or repeated violations, are certainly indispensable to get practical results.

The committee recommends that the clauses relating to the power of entry and closure by authorized officers as stated in Sec. I, Arts. XIII and XIV of this report (which have been of great benefit in the City of Chicago) or clauses to the same effect be included in every ventilation law.

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WITH the publication at last of definite recommendations for a set of minimum ventilation requirements for public and semi-public buildings, which are recommended for legislation, perhaps the most important undertaking of its kind ever inaugurated by The American Society of Heating and Ventilating Engineers has been brought to a successful conclusion. This does not mean that the society has said the last word on the subject. It is more than possible that the requirements as promulgated will be amended from time to time, but the fact remains that the society has now gone on record as proposing something definite and comprehensive and based on the very latest researches covering the ventilation of buildings.

The history of the undertaking is interesting and shows how organized effort can stimulate and develop an idea. It will be recalled that all of the early efforts were to draft a model compulsory ventilation law that could be offered to the various legislatures for adoption. It was only after considerable study had been given to the subject that it was realized no model law could possibly cover the varying conditions in different classes of buildings. All this was brought out in the discussion of the proposed law and it seemed to many that the difficulties were insurmountable. Stimulated, however, rather than discouraged by the discussion, which, as the event proved, was essentially constructive, some one hit upon the clever idea of preparing a set of requirements from which the necessary legislation for a given locality or class of buildings could be prepared.

From that time the undertaking made rapid headway and although the requirements as drawn up were destined to pass through the ordeal of further searching criticism, which postponed the final publication of the recommendations for two years or more, it was probably worth the delay and gave the opportunity for making the final revisions which are seen in the finished report.

The code now goes forth with the imprimatur of the society and may be expected to become a valuable guide to boards of health, as well as to legislators of ventilating laws throughout the country. With its special sections on schools and colleges, factories and theatres, every type of building is taken care of in which the necessity for mechanical ventilation is an important factor.

Great credit is undoubtedly due the heating engineers' society for the completion of this code, but it seems to us that the trade and the public as well should know that the men who did the actual work in patiently developing the code to its final state were Prof. James D. Hoffman, of the University of Nebraska; Dr. E. Vernon Hill, of the Chicago Division of Ventilation, and Frank T. Chapman, of New York.

THE CONSULTING ENGINEER

The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

60—Radiation Supplied by Different-Sized Steam Lines.

QUESTION: As I am interested in district heating, there has come to my notice a problem on this particular kind of work, and I would ask if you can furnish me with a table or formula giving the amount of radiation that can be taken off a high pressure line from 2-in. to 10-in. diameter, at a pressure of from 20 lbs. to 90 lbs. gauge, to supply low pressure radiation at 1 lb. to 3 lbs. gauge pressure.

ANSWER: There are many curves and formulae which will give the information, although perhaps not exactly in the form required. Konrad Meier, for instance, in his work on "Mechanics of Heating and Ventilation," gives complete charts and tables for 70 lbs. mean pressure. Factors are given in a table printed herewith for correcting the formula for friction, velocity and discharge for other mean pressures from 10 lbs. to 100 lbs., the mean pressure being, in this case, the sum of the initial and final pressures, divided by two.

The accepted transmission for radiators per hour, with a room temperature of 70° F., is 250 B.T.U. per hour, per square foot, per degree difference, with 2 lbs. average pressure. The total heat above 32° for 2 lbs. pressure, from the accompanying steam table, is 1,152.5 per pound, and the heat in the condensation at 190° would be 158 B.T.U. per pound above 32°, so that $250 \div (1{,}152 - 152) = 250 \div 994 = 0.251$ lbs. of steam per hour per square foot of radiation at 2 lbs. gauge. Any other room temperature or steam pressure will give different results, but the method of determination still holds.

The discharge from any conduit with a flowing fluid is generally expressed in cubic feet per second, and is equivalent to the area multiplied by the velocity, for the unit of time. The quantities involved in the flow are as follows:

Pf = pressure in pounds per square inch to overcome friction, or the drop in pressure.

W = weight per cubic foot of steam at the mean pressure in the conduit.

V = velocity in feet per second, multiplied by 3,600 for feet per hour.

d = diameter of conduit or pipe in feet.

l = length in feet.

2g = force of gravity = 64.32.

The formula is:

$$Pf = \frac{W}{144}\ 0.0257\ \frac{V^{1.98}}{2g}\ \frac{l}{d^{1.2}}.$$

Any quantity can be determined in the above formula, if the others are known. The chart referred to in Mr. Meier's book gives the quantities for all sizes and drops, in the form of curves. These are computed for 70 lbs. mean pressure, but may be corrected for other mean pressures by means of the factors.

In the above formula the velocity only is given and this would have to be multiplied by the area to obtain the cubic feet and as the weight of steam and its total heat varies with each pressure, the pounds have to be determined by the weight per cubic foot at the mean pressure.

The B. T. U. are determined from the pounds at the final pressure, and the total heat per pound, less the heat per pound in the condensation, which in this case was assumed at 190°. These quantities are given in the accompanying table for a few pressures.

The initial pressure will be the mean pressure, plus one-half the drop, and the final pressure will be the initial pressure minus the drop in the line.

In determining the specific weight the initial condition or total heat of the steam should be taken and the approximate loss by radiation from the main determined and subtracted from the initial heat per pound of steam delivered.

The total heat in the final steam per pound and the pressure will determine whether it is superheated or not, and the B. T. U. per pound discharged in an interval of time. This divided by 250 will give the square feet of radiation capable of being served.

When the pipe is small, with a great drop in pressure and high velocity, the loss by radiation per pound of steam delivered is less than the corresponding difference in B. T. U.

FACTORS FOR CORRECTING FORMULA FOR STEAM AT 70 LBS. MEAN PRESSURE, FLOWING IN PIPES FOR OTHER PRESSURES (KONRAD MEIER). ALSO STEAM DATA FROM MARKS AND DAVIS STEAM TABLES.

Gauge pressure, lbs.	Temp. of steam, deg. F.	Heat in liquid, B.T.U. per lb. above 32° F.	Weight of steam per cu. ft., lbs.	Latent heat per lb., B.T.U.	Total heat per lb. above 32° F., B.T.U.	Factor to correct formula.
Water	190	158.8	.....	....	.....	...
2	217	185	0.0404	967.2	1,152.2	...
10	237.8	206.1	.05907	953.5	1,159.6	3.06
20	257.6	226.2	.0818	940.1	1,166.3	2.23
30	273.1	242	.1043	929.2	1,171.2	1.76
40	285.9	255.1	.1263	919.9	1,175	1.47
50	297	266.4	.1482	911.8	1,178.2	1.27
60	306.7	276.5	.1699	904.4	1,180.9	1.12
70	315.4	285.5	.1915	897.7	1,183.2	1.00
80	323.4	293.7	.2130	891.5	1,185.2	0.91
90	330.7	301.3	.2343	885.8	1,187.0	0.83
100	337.4	308.3	.2556	880.4	1,188.7	0.77

at the final and initial pressures and the steam will be superheated at the final pressure. The properties of volume, weight and total heat, of course, are different than for saturated steam. This condition occurs when passing steam through a reducing valve.

When the loss by radiation in the main is greater than the difference in total heat corresponding to the initial and final pressures some of the steam has condensed in transit. This can be found in pounds by dividing one-half the total B. T. U. loss per pound of steam delivered by the latent heat at the mean pressure, and deducting this number of pounds from the discharge. The reason why only one-half is deducted is that this amount has been reduced to water at the center of the line, allowing a greater capacity for the gaseous steam.

In Question No. 53 (see THE HEATING AND VENTILATING MAGAZINE for November, 1915) this very problem is worked out in detail, only for lower pressures. The method is the same but the formula should be modified as suggested to meet the change in density of the steam.

Whatever heat in the steam is passed into a main, the same amount of heat is received at the end of the line, minus the B. T. U. loss in radiation. The friction formula simply gives the conditions, pressure, etc., of the steam, and the total flow is determined by the size, capacity and loss in pressure, due to friction.

Heat from Sewer Gas.

A system of utilizing gas from a sewage tank for light and heat is described by Charles C. Hommon in *Engineering Record*. By capping the vents of the tanks of the sewage treatment plant at Atlanta, Ga., it has been possible to collect an abundant supply of gas and utilize it for lighting and heating the home of the author, who is chemist and bacteriologist in charge. The gas, it is said, has high calorific value and as a sewage plant by-product can probably be used in other ways advantageously to reduce the maintenance cost of the works.

National Board of Fire Underwriters Adopts Rules Regarding Installation of Blower Systems.

An important action has been taken by the National Board of Fire Underwriters in adopting the requirements set forth by the National Fire Protection Association, covering the installation of blower systems for heating and ventilating and for stock and refuse conveying. This report was prepared by a committee composed of A. M. Feldman, New York, chairman; R. P. Bolton, J. A. Donnelly and others, and in the preliminary form, was published in THE HEATING AND VENTILATING MAGAZINE for May, 1914. The report has since been somewhat revised and was adopted at the last annual meeting of the National Fire Protection Association. Following is that part of the report, in its revised form, referring to blower systems for heating and ventilating:

Blower systems, which are often an economic necessity, usually introduce an additional hazard contributing to the cause and spread of fire, particularly when used for conveying stock and refuse. It is impossible to eliminate the fire hazard from such systems, but reasonable safeguards can be provided to reduce it.

The general standards applicable to blower systems are sub-divided into two classes: (a) heating and ventilating systems and (b) stock and refuse conveying systems.

CLASS A. HEATING AND VENTILATING SYSTEMS.

1. *Blowers* (the word blowers is used to include blowers and fans).

(a) Blowers shall be so located as to be accessible for repairing and lubricating.

(b) Casings to be strongly built and properly reinforced where necessary; joints shall be air-tight. Casings and runners shall be entirely non-combustible, and large enough not to require overspeeding. To prevent accidents,

openings into casings shall be protected with substantial screens or their equivalent.

(c) Bearings and journals to be constructed in accordance with the best modern machine design and so proportioned as to prevent over-

spaces, voids, nor other portions of the building shall be used for air chambers or ducts, unless of fire-resisting construction, and then only by permission of the inspection department having jurisdiction.

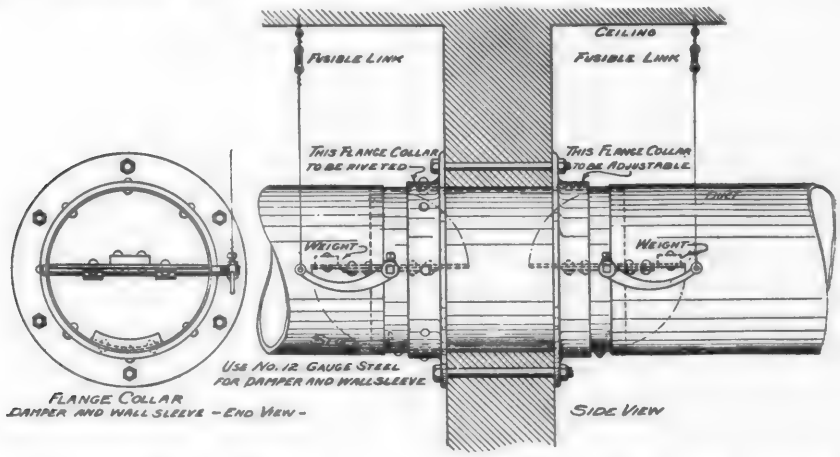


FIG 1—AUTOMATIC DAMPER FOR DUCT OPENINGS IN FIRE WALLS.

heating. The bearings shall be self-oiled and so designed as to prevent leakage of oil. They shall be located outside of casings or ducts wherever possible. If located inside of casings or ducts, oilless self-lubricating bearings shall be used, made of bronze bushings fitted with plugs, such as graphite or metaline.

2. *Ducts.* (The word ducts is used to include ducts, flues, pipes and tubes).

(a) Openings through floors for the circulation of air from one story to another shall not be used.

(b) Entire system of ducts to be self-contained; no rooms, hallways, attics, hollow

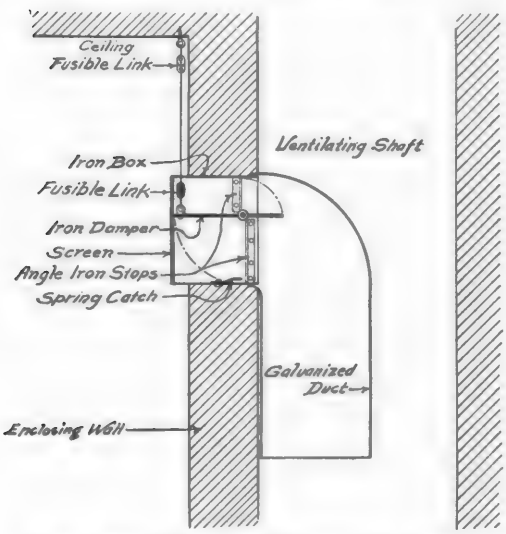


FIG. 2—TYPICAL AUTOMATIC DAMPER.

(c) Ducts shall be made of galvanized iron or other approved non-combustible material. The same applies to enclosures of steam coils used for heating air.

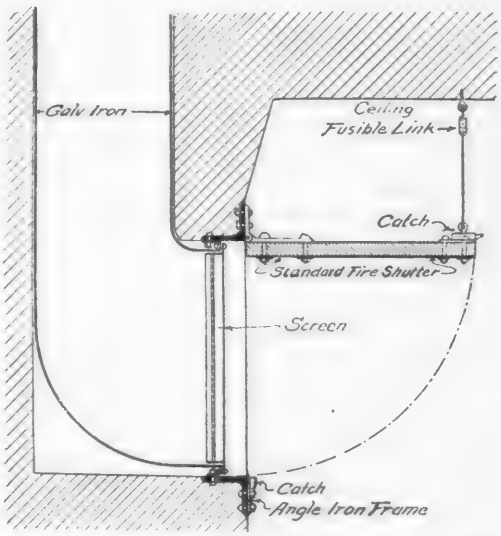


FIG. 3—TYPICAL AUTOMATIC SHUTTER.

(d) To be thoroughly braced.

(e) To be substantially supported by metal hangers, brackets or their equivalent.

(f) Where subject to mechanical injury, ducts to be properly protected.

(g) In no case shall the clearance between any metal ducts and combustible material be less than 1 in.

(h) The passing of ducts through fire walls should be avoided wherever possible. Where ducts pass through fire walls they shall be provided with automatic dampers, or national standard vertical automatic fire doors, located on each side of the wall through which they pass. (See Fig. 1).

(i) All ducts passing through floors shall be made of or protected throughout by approved fire-resisting materials, such as 4-in. brick, hollow tile, or 2-in. cement plastered partition supported by a substantial steel frame.

(j) Where vertical ducts serve more than one floor, automatic dampers shall be provided on all outlet openings directly from such vertical ducts, and at all connections with branch ducts from such vertical ducts (See Figs. 2 and 3).

(k) Joints between ducts and floors, walls or partitions, must be made tight by non-combustible material.

(l) Outlets on supply and exhaust ducts should always be protected by means of register faces or wire screens.

(m) Intake of air to be from outside except in re-circulating systems, and shall be taken only from areas containing non-combustible material. Intakes must be protected with rolling shutters or heavy doors.

Intake and intake rooms, steam coils and blowers, etc., shall be segregated in a room cut off by fire-resisting partitions from other portions of the building.

(n) Blower system should preferably have an emergency or automatic control to shut them down in case of fire. This may be done automatically by means of devices utilizing fusible links, thermostats, or automatic sprinklers. Such installations to be subject to the approval of the inspection department having jurisdiction.

3. *Ventilation of Cooking Appliances.*

(a) Ventilating ducts used to carry off the grease-laden vapors from hoods over cooking appliances, especially in kitchens of large restaurants and hotels, shall be constructed similiarly to boiler smoke flues, and, if of metal, must be of not less than No. 16 U. S. gauge, so substantially built that the grease and gum could be removed from the interior by burning out under a flash fire.

(b) The ventilating ducts shall be an independent system in no manner connected with other house ventilating systems.

(c) Ducts should not be connected to stacks, chimneys or flues used for other purposes.

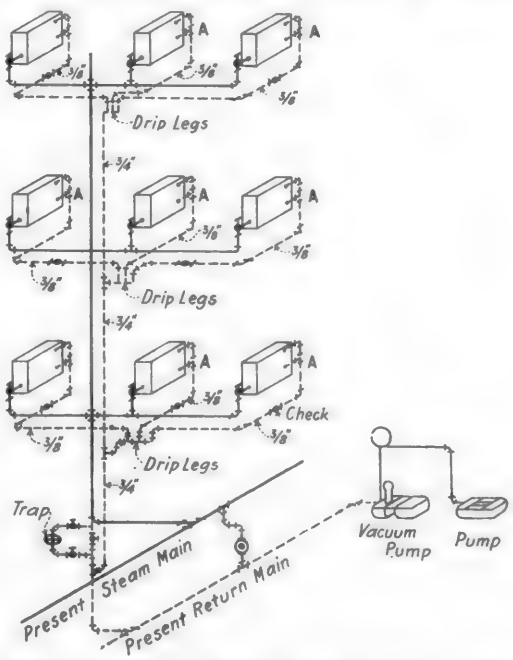
(d) A live steam jet should preferably be provided at the end of the duct nearest the cooking appliances.

CORRESPONDENCE

Simple Remedy for Noisy Heating System.

EDITOR HEATING AND VENTILATING MAGAZINE:

I want to call your attention to the fact that Mr. Ira N. Evans's solution of Question No. 54, in your "Consulting Engineer" department (THE HEATING AND VENTILATING MAGAZINE for December, 1915), was a great surprise to me, as I have great respect for Mr. Evans's ability as a heating engineer. He recommends the installation of a system of return risers, check valves, strainers and air valves on the radiators, the check valves and air valves interconnected. Then he places traps at the foot of each steam riser and a vacuum pump at the end of the return. If this is a simple (?) solution of such or any heating problem, it is beyond my comprehension!



SKETCH OF PROPOSED REMEDY FOR NOISY HEATING SYSTEM.

Check valves on a vacuum system would not work. Those nearest to the vacuum pump would short-circuit and the steam passing those checks would break the vacuum on the pump. Besides, if the checks are intended to pull out some of the water from the radiator by means of the pump, then why not the air be removed at the same time, as is done in any so-called Webster system? What remains for the air valves to accomplish?

Then again, as the air, which is heavier than steam, will have a tendency to escape through the check, would not the steam keep the air valve closed?

The only way to correct a poorly-designed up-feed one-pipe job is to enlarge and properly grade the radiator branches, even without increasing the tee outlets on the risers, but I would change the bushings on the steam connections of the radiators to eccentric ones. Then I would install a good air valve, without an air line. With steam at 2 to 3 lbs., as carried on that job, there is no reason why the air should be exhausted with an air pump.

A. M. FELDMAN.

New York, April, 1916.

REPLY BY IRA N. EVANS.

Taking the criticisms in order, we have first the question of simplicity. This is largely a matter of individual opinion. The writer may rightly be taken to task for the use of this term, but he intended to convey the idea that the proposed changes could be made for a comparatively small sum, and with a minimum interference with the operation of the plant and with the occupants of the rooms.

The building in question is a transient hotel, with rooms intermittently occupied. It is composed of several old private residences thrown together and remodeled into one building. The risers are run mainly in the corridors, and several of the rooms are connected with long run-outs under the floor to the same outlet of the riser.

The job works fairly well on 1 lb. pressure or less at present, but gives trouble when the pressure is raised above that point, as is necessary in cold weather. The remedy proposed by the correspondent in the latter part of his letter would undoubtedly cure the difficulty, but there would be no job, as it would mean tearing up the floors to each radiator, removing carpets, to say nothing of the expense, which the owners would not consider.

A system of air lines to the air valves, with a vacuum, would not help matters, as it would tend to still further reduce the pressure at the far end of the radiators which would make them hang up worse than ever.

A return line vacuum system would involve a new system of returns, with traps or motor-seal valves at each radiator, while practically a new system of piping would be required in either case, with new radiator valves.

The remedy proposed by the writer involves no changes in the present piping, as the ⅜-in. pipe connection was to be made at the opposite end of the radiator from the supply, which is left undisturbed, by simply substituting an eccentric bushing for the present plug. The new pipe can be run inconspicuously above the floor along the base to the point where the riser is located. This would bring most of the construction work in the hallways, with a minimum of annoyance to the tenants.

The only cut in the risers is in the basement for the connection of the trap and new return riser, or air line, whichever one desires to call it. The return in the cellar running through store rooms, wine rooms and various crowded places, would not be disturbed, as the only connection would be at the end of the line in the engine room for the vacuum pump connection.

The correspondent must admit that the ¾-in. and ⅜-in. lines, with simple thermostatic traps at the base of each riser, would cost very much less than the remedy proposed by him.

Regarding the use of air valves, the writer stated in his original answer that "the additional connection from the air valve is not absolutely necessary," but as the connection was small and easy to make and might help, it was considered advisable to include it. Whether the air went out through the air valve or through the return would make little difference, so long as it all relieved.

Regarding the check valves the writer agrees entirely with the correspondent's statement as to their use in general. The purpose of these checks was to retard the movement of air and water in the returns of radiators on the same level and give the slow ones a chance to accumulate a column of water in the drip leg and overbalance the pressure on the supply in order to produce a flow. It is not shown on the sketch at the most advantageous point, which is at the bottom of the drip leg. With 18 in. or 20 in. of water in the ⅜-in. pipe, an additional pull of 1 lb. is produced on the return end of each individual radiator. These pipes are somewhat larger than necessary to produce the action described, but it is impractical to run pipe less than ¾-in. or ½-in. as they are apt to give trouble from stoppage and are too light structurally.

If a proper drip leg could be obtained in all cases, the checks would be unnecessary, but with varying conditions throughout the building, they were used to correct any possible inequality.

The vacuum on the pump and return line has nothing to do with these checks, as the lowest radiator is 20 ft. above the basement, and as the condensation fills the ¾ in. return in a solid column it will produce its own vacuum. The pump simply keeps the return lines clear in the basement. Where radiators on the first floor occur, separate thermostatic traps will have to be used before the return enters the main line to the pump.

If the sketch is carefully studied, it will be seen that each riser forms a heating system

by itself, working on the principle of the steam loop, the radiator forming the cooling surface and the drip leg providing an individual column of water to counterbalance the drop in pressure in the radiator.

The water does not accumulate in the return of any radiator until the rate of condensation reduces the pressure below that in the suppy end. When the column becomes of sufficient weight to overbalance the pressure in the supply end, it flows down the ¾-in. return, accumulating velocity and pulling the air with it.

This is the same principle that actuates the Sprengles air pump which, when used with a column of mercury, served in the past to exhaust the air from electric light globes. It is also the same principle as that of the barometer condenser, the radiator forming the head and the ⅜-in. and ¾-in. pipe the tail pipe.

With the arrangement as shown, undoubtedly the greater part of the condensation would pass through the ¾-in. lines.

The writer agrees in general with all the statements made by the correspondent, but claims that he is also correct and that the arrangement as shown will accomplish the desired results with a minimum of expenditure and changes in the building or in the present piping.

Cataloguing of Articles from Trade Papers by New York Public Library.

An item in the March issue stated that the 200 periodicals now on file at the New York Public Library are all examined as soon as received and index cards for the most important articles are made and filed in the library's catalogue. It was also stated that the library is glad to lend current periodicals for a brief period.

Attention should be called to the fact that this refers only to the Municipal Reference Library, 500 Municipal Building, New York, which is a branch of the New York Public Library, located in the Municipal Building for the convenience of the city departments and employees. At the main building, Fifth Avenue and 42d Street, upwards of 7,000 periodicals are regularly received, none of which can be loaned under any conditions or taken from the building.

Civil Engineers Invited to Share Engineering Societies Building, in New York.

Negotiations are in progress between the United Engineering Society, representing the mining engineers, electrical engineers and mechanical engineers, on one hand and the American Society of Civil Engineers on the other to share the Engineering Societies Building, at 29 West 39th Street, New York. A committee of the civil engineers has made a report favoring the submission of the subject to the members for mail ballot.

The civil engineers' society now has its headquarters on 57th Street, New York, in a building of its own. The plans for cooperation include the joining of the library of the civil engineers with those of the other societies. There are now approximately two vacant floors in the Engineering Societies Building which the civil engineers could occupy, or the founder societies will, if necessary, build an addition on the top of the building.

Sidewalk Ventilation Gratings Disapproved.

The use of sidewalk gratings for ventilating the new portions of the New York subway system has been definitely disapproved by the New York Public Service Commission. This action was taken after the plans for constructing the gratings were made and construction work well advanced, and also after the subway engineers had reported favorably on the use of the gratings.

The whole subject is now reopened and the commission voted to secure the services of an experienced engineer to assist in determining the most desirable method to be used. It will be recalled that the Broadway Association conducted an active campaign against the sidewalk gratings system on the ground that they would prove objectionable to passing pedestrians through the outflow of fetid air, as well as being depositories for the dirt of the street.

The public service commission has placed the solution of the problem in the hands of its engineering member, W. H. Hodge, of Boller, Hodge & Baird, consulting engineers, 149 Broadway, New York.

Congress Urged to Prepare for Trade War.

Appealing directly to its members who, in a recent referendum, went on record as favoring increased foreign trade appropriations, the Chamber of Commerce of the United States has started a campaign in an effort to awaken Congress to the immediate necessity of commercial preparedness for the trade war for foreign markets. The immediate cause of the chamber's efforts are due to the failure of Congress to provide for the appointment of additional commercial attaches and trade commissioners, or for adequate administrative and clerical staff in the Bureau of Foreign and Domestic Commerce, for the study of markets outside of Latin America and separate appropriation for the maintenance of field stations in the United States, or for the application of the civil service law to the field service.

THE BUSINESS OUTLOOK.

V.

By Frank M. Huston,
Financial Editor of the Chicago Evening Post; Editor Rand-McNally Bankers' Monthly.

With unprecedented activity in nearly all lines of industry related to the metal trade, and with profits accumulating in an unprecedented manner and an enormous distribution in the form of wages, it is not surprising that this country should be speeding ahead along the highway of prosperity. The effect of the wide distribution of wages is already being realized, for this touches every line of industry by increasing the buying power of the wage earner.

Just now we are entering a new stage in our progress toward prosperity. The accumulations of profits from the steel mills and from the copper mines and allied industries are mounting up so fast that the time is not far distant when plans for their employment will be given serious consideration. This means an additional distribution of wages and of money for the purchase of materials. Should the war continue another year these considerations will be changed into a realization through heavy expenditures in plant extensions and the additional employment of men.

Already the United States Steel Corporation and the independent mills are putting their plans in force. It is estimated that upwards of $100,000,000 will be expended in increasing the capacity of the steel mills of this country. Between $50,000,000 and $60,000,000 has already been appropriated for that purpose by the United States Steel Corporation, of which $25,000,000 is expended at Gary in the new Indiana Steel Company plant. This appropriation is to be taken out of earnings so that it will be seen that the process is one of the distribution of the profits coming from the war business and the domestic business that has sprung up in this country in the last year, rather than out of new capital enticed from the hoardings of the thrifty.

In the copper industry the situation is equally favorable. Millions of dollars are being distributed as dividends and extra dividends and this goes to stockholders scattered all over the country, and this is an additional incentive and inspiration to broader and greater things. The Wall Street Journal recently estimated the gross war orders for forty-two companies since the middle of 1914 at $2,000,000,000, and twenty-six of these concerns aggregate $1,737,000,000. It estimates net profits on war orders run between 25 and 50 per cent. In addition to the money that has been distributed through dividends there has been an enhancement in market price of $919,323,000 on the outstanding securities of these twenty-six companies, or 71 per cent. This, if realized on, means a wider distribution of profits from the war and if continued as an investment means increased credit available to the holders.

Thus it will be seen that we are now beginning to reap the direct benefits that have accrued us through Europe's misfortune in a substantial way. Many corporations and business concerns which were struggling along to meet their obligations before the war began have been lifted out of their financial straits and placed upon a sound foundation.

Of course this has not taken place without the usual attendant inflation, which has been augmented to a very considerable degree by the change in our banking system. Nevertheless the ultra conservatism of our bankers, due no doubt to the uncertainty as to the ultimate effect of the change in our banking system, has held in check much of that wild speculation that has been experienced in former times of a sudden outburst of industrial activity.

With the prospects fair for a substantial agricultural production and with a very large "carry-over" from last year's unprecedented crop there is no reason to look forward to anything but a continuation of favorable business for a considerable time at least. Money is plentiful and rates are low and the business man who proceeds cautiously but relies on his courage to take care of the demand already in sight has every assurance of success in his enterprise.

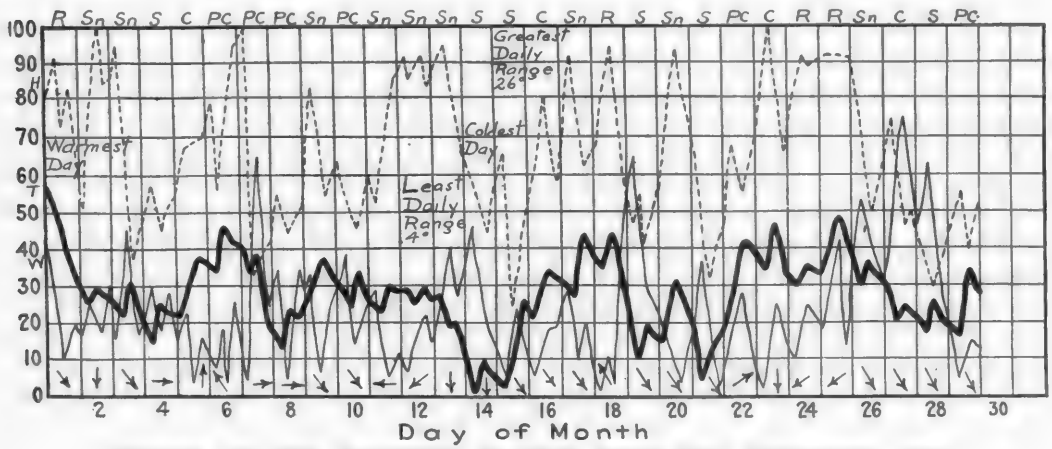
(Copyright, 1916, Kovnat.)

Heating Needs in China.

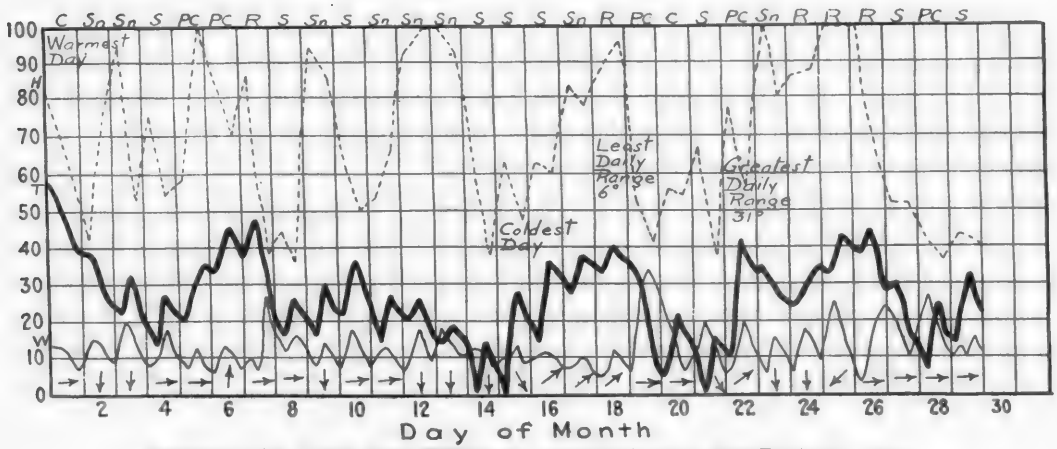
According to a report from Consul-General Edwin S. Cunningham there are at present not more than three buildings in Hankow in which heating plants are installed, but owners of a number of the older buildings would be glad to install modern plants if they were convinced that it could be done in a satisfactory manner. To get this business, he adds, it will not be sufficient for an American manufacturer to establish an agency for the sale of heating plants and plumbing material. The agency should employ a competent and experienced American or European for the purpose of installing the heating plants in such a manner that they will be efficient. An American, for many years a resident of Hankow, says that large buildings are now being constructed in the foreign concessions and plants more or less expensive are being installed. The Chinese, as they construct larger buildings, will employ foreign architects more or less, and will imitate then where they do not employ, and the persons ready to supply at once what is required, at the right price, will get orders in this line.

The Weather for February, 1916.

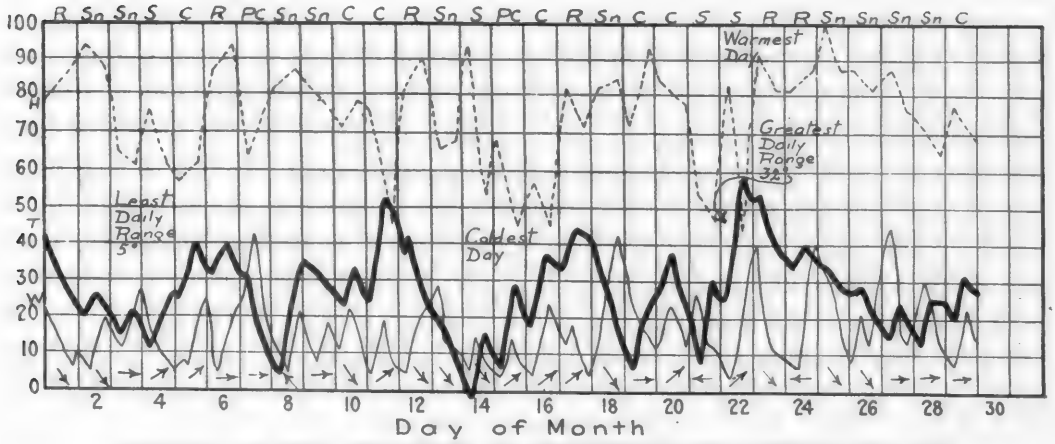
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest Temperature, degrees F.....	61	57	59	50	68
Date of highest temperature.....	1	1	22	22	22
Lowest temperature, degrees F.....	1	0	—1	—3	7
Date of lowest temperature.....	14	15	14	7	7
Greatest daily range, degrees F.....	26	31	32	23	30
Date of greatest daily range.....	15	22	22	18	19
Least daily range, degrees F.....	4	6	5	4	4
Date of least daily range.....	12	18	3	12	28
Normal temp. for month, deg. F.....	27.7	26	27	25	32.8
Normal mean temp. for month, deg. F....	30.7	28	31.8	25.4	33.6
Total rainfall, inches.....	4.49	5.18	2.61	0.87	1.78
Total snowfall, inches.....	13.1	30.3	11.9	8	5.7
Normal precipitation, this month, in.....	3.87	3.56	2.75	2.24	2.86
Total wind movement, miles.....	14,266	8,548	8,883	8,536	8,699
Average hourly wind velocity, miles.....	20.5	12.3	12.8	12.3	12.5
Prevailing direction of wind.....	N.W	W.	N.W.	W.	N.W.
Number of clear days.....	6	9	4	10	9
Number of partly cloudy days.....	7	8	4	5	8
Number of cloudy days.....	16	12	21	14	12
Number of days on which rain fell.....	10	5	5	2	3
Number of days on which snow fell.....	9	8	10	8	4
Snow on ground at end of month, in.....	..	0.5	3.5	..	T.



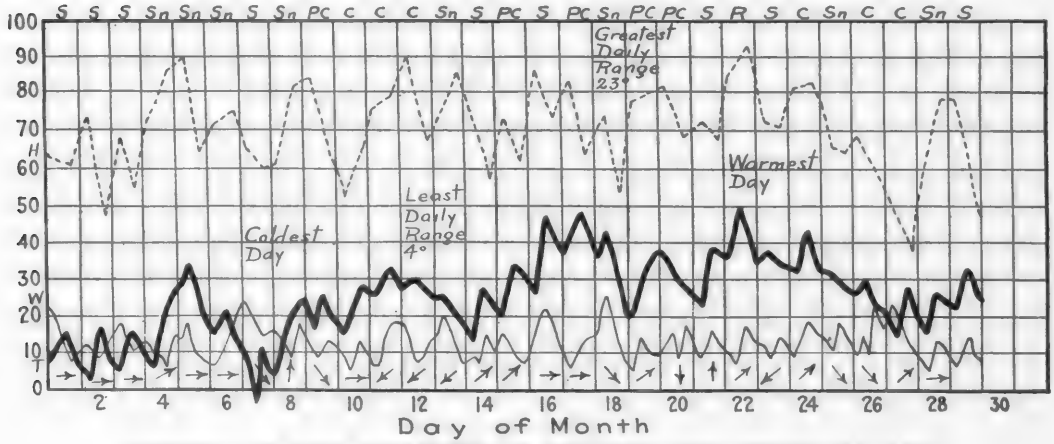
RECORD OF THE WEATHER IN NEW YORK FOR FEBRUARY, 1916.
(Hourly Observations of the Relative Humidity Are Platted on This Chart.)



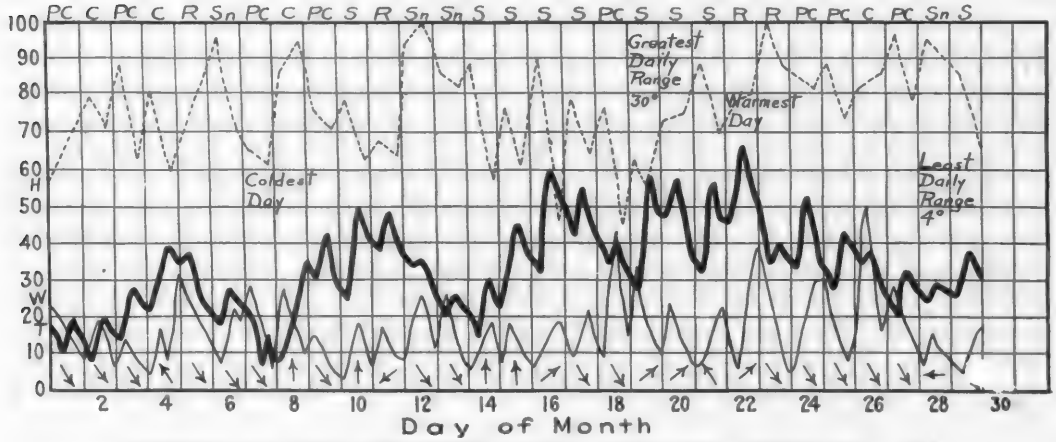
RECORD OF THE WEATHER IN BOSTON FOR FEBRUARY, 1916.


R Sn Sn S C R Pc Sn Sn C C R Sn S Pc C R Sn C C S S R R Sn Sn Sn Sn C
Warmest Day
Greatest Daily Range 32°
Least Daily Range 5°
Coldest Day
H
T
W
Day of Month

RECORD OF THE WEATHER IN PITTSBURGH FOR FEBRUARY, 1916.


S S S Sn Sn Sn S Sn Pc c c c Sn S Pc S Pc Sn Pc Pc S R S C Sn C C Sn S
Greatest Daily Range 23°
Warmest Day
Least Daily Range 4°
Coldest Day
H
T
W
Day of Month

RECORD OF THE WEATHER IN CHICAGO FOR FEBRUARY, 1916.


Pc C Pc C R Sn Pc C Pc S R Sn Sn S S S S Pc S S S R R Pc Pc C Pc Sn S
Greatest Daily Range 30°
Warmest Day
Coldest Day
Least Daily Range 4°
H
T
W
Day of Month

RECORD OF THE WEATHER IN ST. LOUIS FOR FEBRUARY, 1916.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.

Heavy lines indicate temperature in degrees F.

Light lines indicate wind in miles per hour.

Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.

S—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow.

Arrows fly with prevailing direction of wind.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Mid-Summer Meeting of Society to Be Held in Detroit.

At a meeting of the council of the society, held March 29, it was decided to hold the society's mid-summer meeting in Detroit, Mich., during the week commencing July 16. The choice lay between Chicago and Detroit, and the fact that the Detroit members have been so active recently in forming a Michigan chapter of the society was considered a sufficient reason for accepting their invitation to visit Detroit this summer. The Chicago members, it was stated, when the matter was presented to them in this way, generously acquiesced in favor of Detroit.

Eastern Pennsylvania Chapter Organized.

In fulfillment of the plans of the organization committee, composed of J. T. J. Mellon, George W. Barr, E. T. Murphy and W. G. R. Braemer, a new chapter of The American Society of Heating and Ventilating Engineers, to be known as the Eastern Pennsylvania Chapter, was successfully organized in Philadelphia, March 8. The members and guests met at Kugler's restaurant where dinner was served in accordance with a unique set of specifications especially prepared for the occasion. These specifications, which were in typewritten form, each diner being furnished with a copy, were as follows:

SPECIFICATIONS COVERING ORGANIZATION BANQUET

General Description: The work to be done under this specification and accompanying plans includes the installation of a complete feed with all tools and appliances necessary for the manipulation of same, also the construction of an efficient and permanent organization looking towards the heating and ventilating of Eastern Pennsylvania with Camden as a by-product.

General Conditions: The work included under this specification is to be subject to the general conditions written for the entire set of specifications of the building of an American Society of Heating and Ventilating Engineers, whether attached to this part or not and the contractors are notified thereto as an integral part of their contract work.

Definitions: Wherever the word "feed" is used it is understood to mean the various luscious digestibles delivered to the festive board by the operating engineer trading under the name of "Kugler."

Wherever the word "contractor" is used it is understood to mean the party, firm or large corporation about to partake or who has partaken of the above-mentioned luscious feed, to which a whole or a part of the work embraced in this specification shall be awarded.

Workmanship: All work must be done with neatness and despatch, leaving no remnants of feed on the premises. To this end the contractors are particularly instructed to bring with them husky appetites and keen appreciation of the feed as it may appear from time to time during the progress of the work.

Co-operation: The relation of each part of the whole, including the work of the general construction of the chapter, the administra-

ORGANIZATION DINNER OF EASTERN PENNSYLVANIA CHAPTER, AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

tion of its affairs, and promotion of its general good is to be carefully considered by the contractors. All parts of the work are to be arranged so as to harmonize in service and good will with all other parts.

Drawings: The work to be done is based on the attached drawings. It is understood that these drawings accompanying the specification are intended to show the general arrangement of the work, but the exact location and arrangement of all parts may be modified as the work progresses. The drawings and specifications do not undertake to illustrate every item necessary for the work as it is assumed the contractor is a gastronomical expert and capable of manipulating the feed without detailed instructions as to methods or tools to be employed.

Cutting and Patching: The contractors are required to furnish the necessary opening for the reception of the before-mentioned feed and to close same neatly while the *chew* is working.

All unused material shall belong to the contractors and shall be removed by them on completion of the work.

Testing: When the feed is all in place, the contractors' patience shall be severely tested with hot air, explosives, reports and other tortuous means as may be selected by the foreman of toasts.

Valves: This contractor shall absorb not less than five, nor more than six bi-valves. These are to be of the Jersey Coast Salt Type which may be painted with red lead or granulated horse radish, as the contractor may elect.

Accessories and Trimmings: There are to be provided all the necessary accessories and decorations, such as green plumb bobs, bleached flax brushes, red bolt nuts, etc.

Grouting: Suitable foundations for the feed are to be prepared and a grout of not less than one-half pint of Mongolian soup mixed one, three, and five with Puree and Julienne, is to be poured in.

Insulation: The above-mentioned corporation is to be well insulated before filling, with a lining of granulated cork, thoroughly cleaned, after which is to be applied one coat of best metal leaf bronze finished in the Princesse style.

Cooling System: To be divided into a pre-cooler and a re-cooler. The pre-cooler is to consist of a Punch, well soaked in coal tar oil of apricot, from which all other impurities have been removed. If the contractor survives this, he is called upon later to absorb a re-cooler constructed of H_2O at 32° F. or less, direct-connected to chilled Keystone grease, tinted with red lead and yellow ochre.

Heating Plant: To consist of not less than one-half b(r)oiler, mounted on carbon and proteid foundations. In the space immediately surrounding same is to be provided fuel, such as starch of the Irish type, and pea and rice coal, mixed half and half. The latter is to be tinted with yellow ochre.

Packing: All crevices and spaces are to be well packed with natural grass, coated with cotton and oil, extract of hen, etc.

Painting: The entire job is to be given at least one coat of brown or black paint, as may be selected. This paint shall be an extract of the finest chicory and the contractor may be impelled to mix this with caseine and saccharine to prevent flecking or peeling when heat is applied.

Platform: The contractor will at this time be called upon to construct a platform upon which the organization will stand. The material for this platform is to be selected by a nominating committee appointed by the foreman of toasts with the contractors as the final arbitrator of their selection.

The contractors will also be called upon to select a more permanent set of specifications governing future work.

When the speechmaking began, Toastmaster George W. Barr told of the organization of the society itself in 1894, the project taking form through the action of the master fitters' organization in passing a resolution discouraging the presentation of technical papers at their meetings. This brought about the movement for the formation of a technical engineering society for the discussion of heating and ventilating matters. The first professional meeting of the society was held in January, 1895, and Mr. Barr reminded his hearers that this was just 21 years ago. He predicted a brilliant future for the Eastern Pennsylvania Chapter.

J. D. Cassell, who was then introduced, spoke of the opportunity before the new chapter of securing wider publicity for and appreciation of the profession. He referred to the appointment of commissions without engineers and considered this was due largely to the modesty of the engineer in making his capabilities known. He expected the new chapter to take an important part in the uplift of the society and of the heating profession.

The toastmaster then called upon Homer Addams, treasurer of the society, who expressed his gratification over the launching of the new chapter and looked to see the membership reach at least 100. He spoke of the high class of men who were coming into the society, recent applicants including Dr. W. S. Jacobus, president of the mechanical engineers' society, John A.

Stevens, chairman of that society's boiler code committee, and others.

A. C. Edgar was introduced as one of the society's charter members. He stated that he was glad to be present on this occasion, which he felt was equally as auspicious as that of the society's first meeting which he attended.

Frank K. Chew also spoke, and told of the work accomplished by the other chapters and of the opportunities of the Eastern Pennsylvania Chapter.

A nominating committee was then named consisting of A. C. Edgar, H. P. Gant and H. C. Beatty. This committee reported the following ticket which was unanimously elected:

President, J. D. Cassell; vice president, Isaac H. Francis; secretary, George W. Barr; treasurer, Kennedy Duff. Board of governors: J. T. J. Mellon, W. G. R. Braemer and E. T. Murphy.

It was decided to hold the chapter meeting at the Engineers Club, 1317 Spruce Street, the second Thursday of each month, the April meeting being scheduled for April 13. The following were present: Eilert Nesdahl, E. Kessler Webster, Harry C. Beatty, Herbert A. Terrell, W. G. R. Braemer, G. W. Barr, E. S. Berry, J. D. Cassell, August Geiger, A. S. Mappett, J. T. J. Mellon, W. G. Culbert, B. H. Davis, Robert L. Young, William W. Rice, George Boon, Arthur P. Goldsmith, I. F. Grumbein, E. T. Murphy, Lee Nusbaum, William H. Timm, Richard D. Burns, H. P. Gant, William J. Robinson, Kennedy Duff, A. C. Edgar, Horace A. Kottcamp and Joseph A. Waddell, Jr.

The guests of the evening were Homer Addams, Frank N. Chew and George G. Schmidt.

Permanent Organization of Ohio Chapter.

Officers of the newly-formed Ohio Chapter for the ensuing year were elected as follows, at a meeting held in Cleveland, March 10:

President, Robert S. Mayer; vice president, M. L. Crowell; secretary F. G. Phegley, 706 Rose Building; treasurer, F. H. Valentine. Governors: J. H. Bacon, W. C. Green and W. M. Kingsbury.

Car Heating Discussed by the Illinois Chapter.

Car heating, including railroad coaches and street cars, was the topic for discussion at the March meeting of the Illinois Chapter. The meeting was held March 13 and followed a dinner at the Morrison Hotel, Chicago, with President D. L. Hogan in the chair.

The first speaker was Elmer W. Reitz, of the Chicago Car Heating Co., who described the development of railroad coach heating, leading up to the vapor method now in almost universal use by the railroads. The advantage of the vapor system, he said, is the elimination of the danger of freezing which is of the greatest importance due to the standing of empty coaches in cold yards for more or less lengthy periods. The customary practice is to have a row of pipes extending the length of the car on each side, usually ten pipes each 70 ft. long, controlled by four valves. The speaker stated that it was usual to open the ventilators rather than to shut off the heat in the cars.

D. I. Cooke, who is a member of the Illinois Chapter, covered the subject of street car heating, using numerous stereopticon slides to illustrate the various methods in use.

Fifty members and guests were present.

An effort is being made by a "boosters' committee" of the chapter to increase the chapter's membership, as well as that of the society, by interesting many representative heating and ventilating engineers in the Middle West who are not at present society members.

March Meeting of New York Chapter.

The success of the dinner meetings of the New York Chapter was attested by another large attendance at the March meeting which was held in the rooms of the Building Trades Employers' Association, on 33d Street, New York, March 27. No technical topics were taken up, the evening being devoted to a short business session, followed by after-dinner talks. President W. H. Driscoll acted as toastmaster.

The report of the nominating committee placed the following in nomination, the election to take place April 24: For president, J. J. Blackmore and Arthur Ritter; for vice-president, Frank K. Chew and Perry West; for secretary, A. S. Armagnac and F. K. Davis; for treasurer, R. B. Hunt and W. J. Olvany; for board of governors (three to be elected), A. M. Feldman, George W. Martin, W. H. Driscoll, Conway Kiewitz, C. E. Pearce and Richard Ruppell. It was announced that the April meeting will be in charge of a special committee, headed by P. H. Seward, representing the board of governors, and that future meetings will be conducted on the same plan.

The first speaker was A. S. Armagnac. Mr. Armagnac stated that however great the need of co-operation on the part of the chapter members in engineering matters, the first requisite is a closer acquaintance with each other and this, he thought, was being accomplished by the present method of conducting the chapter meetings. He then called attention to a number of topics of the day, such as the approaching meeting of the National District Heating Association in New York, and declared the trade would find much of interest in the program of the association's meeting. Speaking of other topics, he referred to the plans of the British institution to establish additional "British Standards" in heating and ventilating work, and he asked why it was not possible to establish some American standards. "Why not a 'A.H.L.C.' (American heat loss coefficient)," he said, "if we are to have standards of this kind?" Other topics discussed by him were the present status of the New York subway ventilation situation and the national advertising campaign of the American Warm Air Heating and Ventilating Association.

The next speaker was Homer Addams, treasurer of the society, who gave an interesting review of the coal industry in the United States. He declared we are rapidly coming to the use of bituminous coal for all types of heating plants. Mr. Addams, in dealing with the coal industry, related a number of his own experiences, during his early connection with the industry.

The toastmaster then called on Charles E. Carpenter, president of the E. T. Houghton Co., of Philadelphia, who made a thoughtful address on the subject of the initiative, referendum and recall. Incidentally he gave some significant Philadelphia statistics, refuting Philadelphia's reputation of being a sleepy town. "If we do this when we are asleep," he added, "God help you if we ever wake up."

William J. Baldwin, who spoke next, presented a number of designs made by him for a chapter badge. He said the designs were only intended to start the ball rolling and that he hoped to see an effective badge evolved and adopted by the chapter. Speaking of the recent agitation for a change to the metric system and also from the Fahrenheit to the Centigrade thermometer scales, he expressed himself as opposed to any such change, declaring that our present system of weights and measures, etc., was too well ingrained and used to make a change feasible. Especially in connection with long measure, he declared the use of the metric system would play havoc with all our surveys of every sort and would create chaos throughout the land.

George W. Martin concluded the speaking by emphasizing the advantage to the members of attending the forthcoming meeting of the National District Heating Association. Among the papers, he said, which would be of special interest was one on "Relation of the Central Station Steam Company to Its Customers," by William J. Baldwin, Jr., consulting engineer for the New York Steam Company.

"British Standards" for Heating and Ventilating Work.

In connection with the elaborate plans for research work on problems bearing on heating and ventilation, which have been undertaken at the University College, in London, Sam Naylor, the new president of the British Institution of Heating and Ventilating Engineers, stated in his address before that body, that the standardization of all things appertaining to heating and ventilating was the most important work undertaken by the institution. "During the last few years," he added, "a new vista has opened to us in the research work being done at the University College and in the near future there is a prospect of important results being available to the members for their daily use and assistance. It is important that these standards should be accurate—accurate by experiment and not by deduction or calculation—so that time will necessarily be required, for accuracy is more important than speed. I venture to think that when this work is accomplished, the 'British Standard' will be the textbook of the world, and the boasted knoweldge of Continental rivals will be found to be not altogether without faults."

The summer meeting of the institution will be arranged for by the council. The autumn meeting is scheduled for October 10 and the next general meeting for February 12, 1917, at the Holborn Restaurant, in London.

New York School of Heating and Ventilation Holds Fourth Annual Dinner.

The completion of the fourth year of the class conducted by Charles A. Fuller under the name of the New York School of Heating and Ventilation was celebrated with a dinner at Stewart's Restaurant, New York, March 13. Covers were laid for 134 guests who took advantage of the occassion to endorse the work done by the leader of the class, Mr. Fuller, and to make it a rallying point for further efforts in the same line, both in New York and throughout the country.

Among the speakers were Frank K. Chew, Milton W. Franklin, W. H. Driscoll, J. J. Blackmore, Charles A. Fuller, James A. Donnelly, C. W. Obert, A. H. Bosworth and H. H. Pratt. One of the points brought out by Mr. Franklin was the need of absolute honesty on the part of the engineer if he was going to reap the full reward of the opportunities that were now opening up to him as a result partly of the European war and partly through the wider recognition of the services of the engineer.

President W. H. Driscoll of the New York Chapter, spoke of his own early experiences when the science of heating was hardly more than a rule-of-thumb proposition and declared that the work of the school was helping largely to meet the demand for more scientific methods in heating engineering work.

J. J. Blackmore, until recently secretary of the heating engineers' society, said that the success of the school emphasized the fact that the society should have taken the initiative in starting this work, but that the outlook for society work in this direction was now very promising. At present four colleges have chairs covering the science of heating and ventilation and courses are being formulated in several other colleges. He looked forward to see the time when a heating engineer would be consulted for residence equipment, as well as for larger installations.

Charles A. Fuller, who was then called on, expressed his gratification at the success of the school as reflected in the large attendance at the dinner. He stated that assurance had been given by the heating engineers' society that graduation from the school would count in considering a man's application for membership. As regards college courses, Mr. Fuller felt that a post-graduate course was not needed so much as the kind of instruction given by his school.

James A. Donnelly told of his long interest in the project that finally took form in the class conducted by Mr. Fuller. He had been an advocate of such a course for many years in discussing the subject at meetings of the heating engineers' society.

C. W. Obert, the new secretary of the American Society of Heating and Ventilating Engineers, was called on for a few words and he responded by expressing his pleasure at getting in closer touch with the heating fraternity through his new duties.

A. D. Hoxie, who was the last speaker, stated that an alumni association of members of the class would be formed March 27, and a permanent organization effected.

M. J. Sage was the toastmaster and before the serious speechmaking began the guests were treated to one of Jack Armour's bursts of oratory that more than prepared the way for the remainder of the programme.

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

HEATING—

Electric Heating; Its Present Position and Future Development. George Wilkinson. Abstract of paper before Inst. of Elec. Engrs., at Edinburgh. Ills. Also discussion. 2,500 w. Eln.—Dec. 24, 1915. Advantages of thermostatically controlled heaters. 40c.

LIGHT AND HEAT—

Modern Systems of Independent Lighting and Heating. Ills. 1,800 w. Nt.—Jan. 6, 1916. Oil, oil gas, and petrol-air gas systems. 40c.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

New State Association in Maine.

An association of master steam and hot water fitters was formed in Portland, Me., February 25, which, it is hoped, may be developed into a State association. At the organization meeting in Portland, most of the heating contractors of that city were present. The organization will be affiliated with the National Association of Master Steam and Hot Water Fitters. Officers were elected as follows; President, Arthur B. Fels; vice president, Arthur H. Moulton; treasurer, E. A. Wheeler; secretary, F. A. Davis. A committee was also appointed to draw up a set of by-laws. The following were present at the meeting: Fred E. Wheeler, Arthur H. Moulton, Christopher Madsen, G. F. Scribner, Arthur L. Knight, M. C. Hutchinson, W. R. Sawyer, Freeman Palmer, Myles O'Sullivan, Arthur B. Fels, Charles J. Tilton, Carl B. Brackett, Virgil L. Watson, W. W. Johnson, William E. Allen, H. F. Stuart, Fred Z. Butterfield, George H. Stevenson, James Boyman, Frank A. Davis, Iver H.

Iverson, E. A. Wheeler, all of Portland and vicinity; E. W. Goss, of Lewiston and T. W. Kerrigan, of Lewiston.

Organization of Master Fitters in Richmond, Va.

Master steam and hot water fitters in Richmond, Va., have effected an organization, with James E. Philips as president and Garret Boehling as secretary. Among the members of the new association are the Richmond Engineering Co., Pemberton & Benson, John E. Rose Co., Howard M. Delaney, the Carle-Boehling Co., James E. Philips & Son, McNichol & McMahon, Terrell E. Beckner, Pemberton & Benson and William Sikkelee.

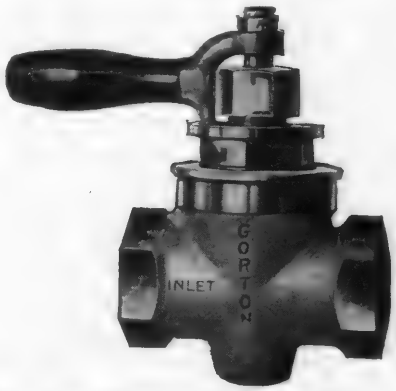
NEW DEVICES

A Quarter-Turn Packless Radiator Valve.

A valve that is described as easier to close than it is to open a window has lately been brought out by the Gorton & Lidgerwood Co., 97 Liberty Street, New York. It is known as the Gorton quarter-turn packless valve. A quarter turn of the handle in either direction opens or closes the valve. It is not necessary to stoop down to turn the handle. A touch of the foot is all that is required.

A number of unique features distinguish this valve which is made of steam metal of heavy pattern. It is not only packless, but all parts are interchangeable. The inside of the valve is cone-shaped, accurately turned to receive a cone-shaped disc, in which is a full-sized straightway opening. A quarter turn of this disc in either direction, as stated, opens or closes the valve. The disc seats itself upon the inner surface of the valve body and is held in place by a bronze spring, so that neither grit or dirt can come in contact with the valve seat. The disc and valve stem are connected by a loose joint which makes it impossible to throw the disc out of its seat.

GORTON PACKLESS RADIATOR VALVE.



VIEW SHOWING CONE-SHAPED CONSTRUCTION OF GORTON PACKLESS RADIATOR VALVE.

The disc is made of a mineral composition that is not affected by high steam temperatures, or by hot or cold water. In use it has been found not to stick or corrode, being apparently as indestuctible as the valve body itself.

The full size, straightway opening through the valve provides an unrestricted and easy flow of steam and a rapid return of the water from the radiator. This feature, it is stated, makes it possible to use a valve one size smaller than if it were the ordinary radiator valve. The valve is made in both the radiator and straightway patterns for all systems of steam, vapor, vacuum and hot water heating and the manufacturers emphasize the high grade of material and workmanship used in its construction.

New Type of Automatic Draft Control.

An interesting solution of the matter of draft control for use especially with fuel gas appliances, is an automatic draft regulator which has been brought out by the Lezius Automatic Draft Regulator Co., Cleveland, O. This device consists of a flue pipe tee made in various sizes, free and open at the bottom, and having a delicately-weighted aluminum gate or flutter valve fitted in the top or outlet; also a second gate or flutter valve without weight swung from a hinge in the tee. If there is little or no draft in the chimney, the outlet flutter remains open and the tee flutter closed. If the draft is small, the

tee flutter inclines slighty; as the draft increases, the tee flutter inclines more, and when the draft becomes excessive, the gate is drawn inward to a perpendicular position, partially closing the area of the flue pipe and drawing a great proportion of the air from the room rather than the heat of the chimney, thus lowering the chimney temperature as well.

A great saving of fuel, it is stated, is possible with these regulators because of their being self-acting, depending upon the velocity of draft. Where down-draft occurs, the top or outlet flutter valve closes in-

NEW AUTOMATIC DRAFT REGULATOR.

stantly. In that case the products of combustion momentarily escape into the room through the tee flutter, which then opens outwardly.

Should mortar, bricks or soot fall in the chimney and obstruct the flue opening, if there is no regulator or outlet of some kind for the products of combustion to escape, the flame would be smothered and gas escape unlighted through the burner. This would also happen if a down-draft should blow out or smother the flame. When such things occur, with draft regulators installed, the flame remains lighted and the escape of the products of combustion into the room serves as an indication of flue trouble.

Another function which, it is stated, is performed by this device is in connection with the ventilation of a kitchen with a gas range. Fitted high on the flue pipe leading from a gas range, the draft usually is great enough to draw air through the tee flutter, so that smoke and steam from the cooking on the top burners is carried up the chimney.

Ric-Wil Underground Pipe Covering Co., Cleveland, O., manufacturers of the Ric-Wil tile underground pipe conduit, has changed its name to the Ric-Wil Co.

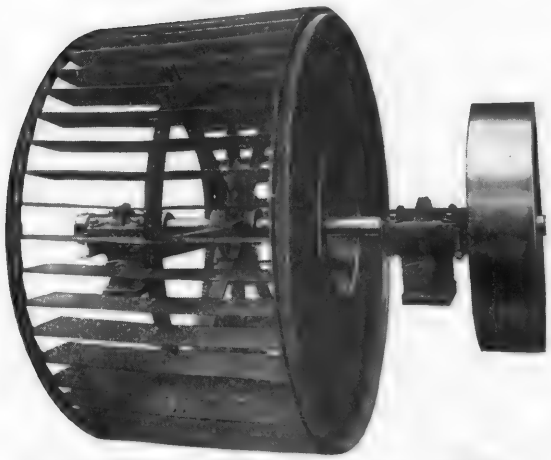
New Publications.

MINE VENTILATION STOPPINGS, WITH ESPECIAL REFERENCE TO COAL MINES IN ILLINOIS, is the title of Bulletin 99, recently issued by the United States Bureau of Mines. The author is R. Y. Williams. The author states that one of the most obvious conclusions from the inspection of several hundred stoppings is that the efficiency of a mine stopping to prevent the leakage of air depends more on the care with which the points are made than on the material that is used in construction. Some concrete stoppings were found to leak large quantities of air, because they were not set into the rib, and new tongue-and-groove stoppings were tight when carefully constructed. A protest is being made against high velocities in the ventilating currents in coal mines. Among other things, it was brought out that the weight of fine dust that is in suspension in the mine air varies approximately as the cube of the velocity of the ventilating current. This relation, states the report, has been established by W. H. Carrier, chief engineer of the Buffalo Forge Company, in experiments to determine the weight of material which can be handled by velocities above critical speed. The greater the velocity of the air, therefore, the larger will be the amount of fine coal dust that will be in suspension and deposited evenly along the entry way to assist in the propagation of an explosion throughout the mine.

GRAPHIC STUDIES IN ULTIMATE ANALYSIS OF COALS, by Oliver C. Ralston, has been published by the Bureau of Mines, Department of the Interior as Technical Paper 93. The paper presents the results of a study of the most reliable published analyses of coal. The analyses are studied from several different angles. The method of plotting used has served to reveal certain facts and laws that have not been suspected, as well as showing graphically much information that has been expressed in extensive tables of figures and in long statements that have been difficult of interpretation.

Trade Literature.

GARDEN CITY FAN COMPANY'S GENERAL CATALOGUE No. 160, for 1916, has been issued, covering this company's important line of cycloidal fans and blowers, Garden City fans and blowers, hot blast heating apparatus, induced and forced draft apparatus, air washers and conditioners, and vacuum blowers. The fact that the products represent an experience of 35 years in the fan and blower business is mentioned as an indication of their character and quality. The company's cycloidal multivane fans are given first place in the catalogue, being described as different from all other fans, the vanes or blades being set at



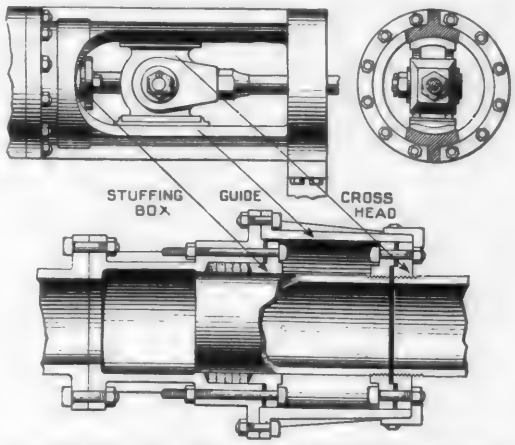
CYCLOIDAL MULTIVANE FAN WHEEL.

an angle to the shaft. They are regularly built in all types and styles, with any number of vanes. It is stated that severe and exhaustive tests at the hands of pneumatic experts have proven that, as compared with any fan using blades fixed parallel with the shaft, the cycloidal will deliver more air with less power and at a lower speed. The company also emphasizes the mechanical construction of its fans, all shafts, for instance, being ground and of polished carbon steel. Many detailed views show the construction of the cycloidal fan, to which are added the necessary data. The catalogue concludes with several pages of miscellaneous engineering data. Size 6 x 9 in. Pp. 143.

BRASS AND COPPER, covering the Star brand sold by the U. T. Hungerford Brass & Copper Co., 80 Lafayette St., New York, is the title of a new catalogue, consisting of over 400 pages, in cloth covers. The contents are classified in separate departments, thereby providing the trade with a concise price list, together with lists showing material aggregating over 5,000,000 lbs. carried in stock ready for shipment.

SINGLE INLET TYPE, CYCLOIDAL MULTI-BLADE FAN WHEEL.

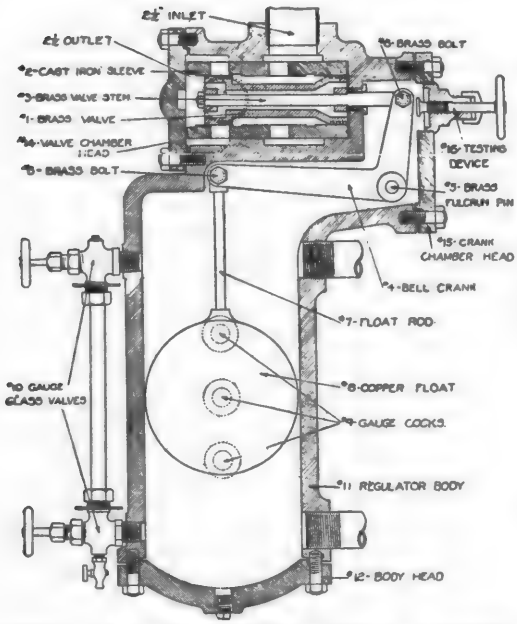
THE ROSS "CROSSHEAD-GUIDED" EXPANSION JOINT, described as a permanent, leakless, long-travel expansion joint for high and low pressure steam, oil, gas and water piping, is featured in a new catalogue issued by the Ross Heater & Mfg. Co., Buffalo, N. Y. This expansion joint was designed by S. C. Ross, formerly with the Alberger Heater Co., of Buffalo. It has been under observation in installations for the past five years on high and low pressure steam and on hot water lines, in sizes up to 14-in., and it is stated that not one of the forty fittings on this job have ever had a ring of new packing put in it or has had a gland pulled up. The new plant of the Remington Arms & Ammunition Co., at Bridgeport, Conn., has about 40 of these fittings in sizes from 4-in. up to and including 16-in., and the company states that it has just



COMPARISON OF MECHANICAL PRINCIPLE OF THE ROSS EXPANSION JOINT AND PISTON ROD, STUFFING BOX, GIRDERS AND CROSS HEAD OF STEAM ENGINE.

shipped three 16 in. cast-steel fittings which will operate on 180 lbs. steam and 300° superheat. The catalogue describes the fitting in detail, its mechanical principle being likened to the piston rod, stuffing box, crosshead and guides of the ordinary steam engine. Size 6 x 9 in. Pp. 16.

RAY'S CONTINUOUS FEED-WATER REGULATOR, described as the final word in feed-water regulation, and the only one-piece continuous feed-water regulator on the market, is brought to the attention of the trade in a new circular published by the Ray Mfg. Co., Louisville, Ky. This device, it will be noted, has the float chamber, water column and feed valve all combined in one piece. According to tests as described in the circular, made with a steam flow meter, measuring the output of a boiler, it was shown that the Ray regulator will give a continuous feed of water to the boiler at the



THE RAY CONTINUOUS FEED WATER REGULATOR.

exact ratio it is being evaporated. No adjustment, it is stated, is necessary, or tinkering with expansion tubes, diaphragm or other delicate devices, nor, it is added, will cold or heat affect it.

THE PIPOGRAPH, a unique calculator for figuring the net cost per foot of pipe, either black or galvanized iron or steel, has been brought out by the Pipograph Co., 51 Cliff Street. The Pipograph measures 9 in. in diameter and has a superimposed disc which may be turned to the point desired. All pipe discounts from 35% off the list to 81% on all sizes from ⅛-in. to 4-in. pipe are shown. To get the net cost per foot of pipe the upper disc is turned until the slot is opposite the discount desired. The price for each size pipe may then be read direct. The Pipograph is mounted on cardboard and is printed in two colors. The hole in the center clasp makes it easy to hang up for quick reference. Copies of the Pipograph may be obtained from the book department of THE HEATING AND VENTILATING MAGAZINE on receipt of the price, $1.00.

New Magazine-Feed Boiler.

A recent addition to the Bernhard line of boilers, made by the Kanawha Mfg. Co., Charlestown, W. Va., is a magazine-feed boiler, which is designed to burn all kinds of coal, from the cheapest grades of bituminous coal to all grades of anthracite in sizes up to stove coal. The boiler was designed by J. B. Bernhard, who has placed many successful designs on the market.

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TRADE AND MISCELLANEOUS NOTES

Coming Events.

April 27-28, 1916—Convention of the National Metal Trades Association in New York. Headquarters at the Hotel Astor.

May 16-19, 1916—Annual convention of National Pipe and Supplies Association in Pittsburgh. Headquarters at the William Penn Hotel.

May 16-29, 1916—Annual convention of the National District Heating Association in New York. Headquarters at the Hotel Martinique, Broadway and 31st street.

June 14, 1916.—Annual convention of the National Warm Air Heating and Ventilating Association, in Detroit, Mich.

July 18—, 1916.—Mid-Summer meeting of The American Society of Heating and Ventilating Engineers, in Detroit, Mich. Secretary, C. W. Obert, 29 West 39th Street, New York.

Deaths.

George W. K. Taylor, president of the McMann & Taylor Co., New York, wholesale dealers in iron pipe, fittings and valves, died suddenly March 5. He was 59 years old. Mr. Taylor was identified with the pipe trade throughout his business career. He was for many years with the Eaton, Cole & Burnham Co. In 1893 he became associated with Henry W. McMann and established the firm now known as McMann & Taylor Co. At the time of his death he was also treasurer of the National Pipe and Supplies Association. He leaves a widow, two sons and one daughter.

Samuel A. Esswein, president of the S. A. Esswein Heating & Plumbing Co., Columbus, O., died February 21 in Cleveland from acute nephritis. Mr. Esswein was 47 years old. He was well known in trade circles throughout Ohio, having long

Genuine Armstrong Stocks and Dies

MALLEABLE HINGED PIPE VISES

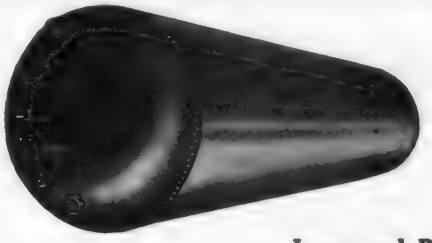
PIPE CUTTERS

PIPE MACHINES, HAND OR POWER

The Tools of Constant Service

Manufactured by — Write for Catalog

THE ARMSTRONG MFG. CO., 321 Knowlton St., BRIDGEPORT, CONN.



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Copper Hot Water Boilers

For Large Apartment Houses, Hotels, Hospitals, Restaurants, and Public Institutions.

Long and Reliable Service Guaranteed.

Engineers recognize the high character of our product by specifying "The Dahlquist Boilers" on their most exacting work. Write for catalogues

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been identified with the heating and plumbing business. After he had learned the plumbing trade he formed a partnership with G. L. Saunders under the name of Saunders & Esswein. Some years later he purchased his partner's interest and incorporated the company under its present name. He was a past president and a past secretary of the Ohio Master Plumbers' Association, and was also president of the Cleveland Master Plumbers' Association. He is survived by a widow, one brother and two sisters.

Alexander Saunders, president of D. Saunders' Sons, Inc., Yonkers, N. Y., manufacturers of pipe cutting and threading machinery, died February at his home in that city. He was 77 years old. Mr. Saunders succeeded his father as head of D. Saunders' Sons, and was actively engaged in business up to the time of his death. He leaves a widow, one son and two daughters.

Walter Higgins, one of the four honorary members of the National Association of Master Steam and Hot Water Fitters, died at his home in Washington, D. C., January 28. He was 91 years old.

William H. Bowers, Milwaukee, Wis., a well-known heating contractor of that city, was fatally injured by a trolley car in Milwaukee, February 14, and died three days later. He was 72 years old. Mr. Bowers was a member of the National Association of Master Steam and Hot Water Fitters, and was active in the Wisconsin State and Milwaukee local associations.

Miscellaneous Notes.

Building Operations for February compiled by the American Contractor for 76 cities showed a gain of 20% over the corresponding month in 1915. The figures were $53,219,098, as compared with $44,280,506. Almost all of the larger cities showed increases, with the exception of New York. There the net loss for all five boroughs was 18%, although Brooklyn had an increase of 59%. The totals for the entire city were $10,344,482, as compared with $12,558,981 a year ago. Chicago had a gain of 56%, the figures being $7,354,200, as against $4,701,500.

Freight Car Supply Co-operation is the title of a timely circular sent out by W. S. Andrews, general superintendent of transportation of the Queen and Crescent Route, in connection with the prevailing car shortage. Some of the ways in which shippers and receivers can materially assist in this vitally important matter are mentioned as

Let Separate Heating Units Do the Work

Why install one large unit to heat a café or grill room which is in use perhaps twenty hours of the day, and also a room which is used perhaps only four hours a day? Investigate the

Sturtevant Electric Heat Blower

The Ideal Small Heating Unit

Send for Bulletin 219-V

B. F. Sturtevant Co., HYDE PARK, BOSTON, MASS.

And all principal cities of the world

RELIABLE

Vacuum and Vacu-Vapor Heating Equipment is Really RELIABLE

The BISHOP-BABCOCK-BECKER CO.

Manufacturers, CLEVELAND, O.

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(1) not ordering more cars than are actually needed; (2) by loading cars as quickly as possible to full capacity and furnishing billing promptly so that there will be no delay in starting the car to its destination; (3) by loading car properly so that it will not be necessary to delay it in transportation, adjusting the load or transferring it to another car; (4) by loading or unloading cars as soon as placed, regardless of free time allowance; (5) by notifying carrier as soon as cars are loaded or made empty and ready to remove; (6) by not using a box car when a gondola or flat car will serve, as box cars are usually in greater demand; (7) by endeavoring to have reconsigning orders placed in advance of arrival of car so it may be switched to proper track on arrival, instead of being placed on a yard track awaiting disposition. Suggestions are also given of ways in which the carrier can help to relieve congestion.

Chicago, Ill.—A special committee of the Chicago Political Equality League, one of Chicago's prominent women's organizations, has been appointed to make a survey of all moving picture theatres and to work for new ordinances covering this class of buildings. The scope of the survey includes a study of the types of films shown. The league's moving picture committee, in a previous report, had stated that it had visited 157 theatres. In 19 theatres the ventilation was reported as bad, and in 14 the sanitation was reported poor.

Newark, N. J.—Deciding that it had waited long enough for the completion of certain improvements in the heating and ventilating systems at the City Hall, the contract for which was given to James F. Kelly Co., April 22, the building committee of the Common Council voted to remove Kelly from the job and employ another contractor to clean up the odds and ends left undone. The action followed a peremptory three-day notice served on the Kelly company.

Pontiac, Mich.—In order to convince the landlord that a waiting room of the Detroit Union Railways was not being heated in a proper manner, the company installed a thermograph in the room which gave a continuous record of the temperature. This record showed that during the period the highest temperature in the waiting room was 62° F., with 32° F. outside, and that for most of the time the temperature was considerably below that point.

Seattle, Wash.—Acting on complaints of insufficient heating of the street cars in Seattle, a hearing was arranged before the Public Service Commission against the Puget Sound Traction, Light & Power Co.

Chicago, Ill.—Meetings have been held at many different points in Illinois recently for the purpose of explaining the new school school sanitation law which recently went into effect in Illinois. The parts of this law affecting the heating and ventilating of school buildings were published in THE HEATING AND VENTILATING MAGAZINE for January, 1916.

Galesburg, Ill.—The condition of all the

Jenkins Bros. Valves

Always dependable. Interchangeable in every part. Parts can be duplicated and replaced even where valves have been in service for years. In most cases the simple renewal of the disc (inexpensive and easily inserted) makes the valves as good as new. Jenkins Bros. Valves last longer, give less trouble, and are less expensive in maintenance than common metal seated valves. *They always have trade mark as shown in the cut.*

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TO INDICATE or RECORD TEMPERATURES and PRESSURE

They have a distinctive quality with a fineness of mechanical detail which insures Accuracy and Durability under the hardest Service

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public schoos in the city with respect to heating, ventiation, etc., according to a detailed report of W. F. Boyes, county superintendent of schools, is satisfactory and generally in accordance with the provisions of the recently-enacted sanitary law. In three schools there was no ventilation except by the windows, but the report states "no doubt means will be devised to meet the conditions within the required time."

Boston, Mass.—The plan followed in connection with the ventilation of the Winchester schools is to place in each window a cloth screen equal in size to one sash. When the schools are in session the screen takes the place of the ordinary window sash, which is thrown open. The theory is that there will be a constant passage of air through the cloth and that this will not cool the room any more rapidly than the cold glass of the ordinary window. The room may therefore be kept at the desired temperature with an inflow of fresh air. The rooms so equipped are differentiated from "open-air" rooms and from the results already secured they show an improvement in the general health of the pupils which compares favorably with the results secured in "open-air" schools.

Spokane, Wash.—A special committee appointed by President George F. Weeks, of the Spokane Chamber of Commerce, has been appointed to investigate conditions of the public schools of Spokane with reference to congestion and ventilation.

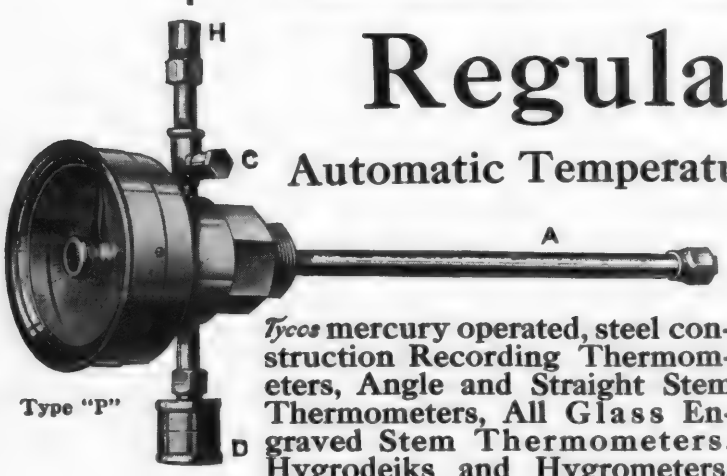
Washington, D. C.—The plan to erect the proposed central heating power plant on the Charles River front has brought forth numerous objections on account of the fear that the smokestacks might prove an unsightly feature. Among those opposed to this site are members of the American Federation of Arts and the American Institute of Architects. However, at a recent meeting of the Washington Citizens' Association, a motion was passed favoring the site at Water and 14th Streets, it being stated that the smokestacks as designed would not prove unsightly and also that this location would increase the population of South Washington. The plans for this location have already been approved by the Treasury Department.

Chicago, Ill.—The buildings and grounds committee of the Board of Education has voted to make an investigation of the efficiency of the Berry window ventilator, following a protest by the Orr & Lockett Hardware Company that the merits of this

H&M Thermometers

Regulators

Automatic Temperature and Pressure



Type "P"

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Mark this: — Every Instrument bearing H & M *Tycos* makes honest claim to supremacy because every manufacturing step is carefully worked out in detail, applications carefully studied.

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ABSOLUTELY FREE FROM THE FAULTS OF PACKED VALVES

Leakage due to the inefficient packing; cheap appearance; and poorly constructed handles that burn at every touch, are unknowntousers of

DETROIT PACKLESS RADIATOR VALVES

No other valve is equipped with the Detroit Packless feature—the **definite assurance against leakage.**

No other valve has such a handsomely proportioned and velvety appearance. The handle is of polished mahogany, and the body a dull soft finish with highly nickeled trimmings—easy to keep clean.

No other valve is so easily manipulated. Besides its ornamental appearance, the valve is made to fit the grip easily, and its well rounded surface positively avoids any recesses where dirt might accumulate.

Brooklyn Y. M. C. A.
Equipped with Detroit Packless Radiator Valves

Architects:
Trowbridge & Ackerman
Heating Contractors:
Baker Smith & Co.

Specify Genuine Detroit Packless Valves.

Send for Catalog V

DETROIT LUBRICATOR CO.

Makers of Stewart Carburetors

LARGEST MAKERS OF RADIATOR VALVES IN THE WORLD

ventilator had not been given due consideration.

Chicago Ventilation Commission held a meeting and dinner at the Morrison Hotel, Chicago, when the subject of hospital ventilation was further discussed. Dr. E. Vernon Hill, chief of the Chicago Division of Ventilation, who presided, stated that tests of mechanically-ventilated hospitals and naturally-ventilated hospitals would be made shortly and the results submitted at a subsequent meeting of the commission.

Eastern Supply Association, at its winter meeting in New York, February 16, adopted the following resolution regarding lump bids or estimates of jobbers to contractors: "Resolved, That this association, after a very careful consideration of the question of giving lump bids (generally termed estimates) considers this practice harmful to the best interests of this industry, and it is, therefore, the sense of this meeting that the furnishing of such bids be disapproved." President L. O. Koven, in his address, stated that the trade is feeling greater confidence in the future. "Stocks," he added, "have gone up in value and the wise man is keeping a constant watch on the market so as to sell the goods which he has in stock on a basis of what would be his cost at the time when he submits his price to his customer. Unless the manufacturer and merchant are very careful in times of a rising market they will surely lose more on the drop than they had previously made on the advance." The subject of a larger discount from manufacturer to jobber and the 10% cash discount plan between jobber and retailer was carried over to the June meeting.

Chicago, Ill.—What is described as a notable achievement of the year in Chicago ventilating circles is the confirmation by the courts of the standards set forth in the city's ventilation ordinance and enforced by the division of ventilation of the health department. It is stated that every important point in the division's interpretation of the ordinance has been sustained after long-continued proceedings, begun in 1913. The ordinance went in effect in 1910. Out of 600 theatres in Chicago, which have been equipped with ventilating systems in compliance with the ordinance, it is said that less than half a dozen are still in an unsatisfactory condition, and in these cases the leases are shortly to expire or the buildings are to be remodeled for other purposes.

Portland, Me.—Plumbing, Steam and Metal Salesmen's Association of Maine held its tenth annual meeting and dinner at the Riverton Park Casino, Portland, March

THE Webster

AIR CONDITIONING APPARATUS

WEBSTER Air Washer and Air Conditioning Apparatus is constantly demonstrating its ability, under a wide variety of exacting conditions, to effect and maintain any desired temperature or humidity.

Whenever a highly efficient and thoroughly dependable air washing, air cooling or air conditioning system is required, WEBSTER Apparatus, by reason of its exclusive advantages, is selected by engineers, architects and owners.

No air conditioning problem is too difficult for us to solve. Our air conditioning engineering staff is second to none in existence. Give us the opportunity to prove this by taking up your next air conditioning problems with us.

We guarantee results in any problem we undertake.

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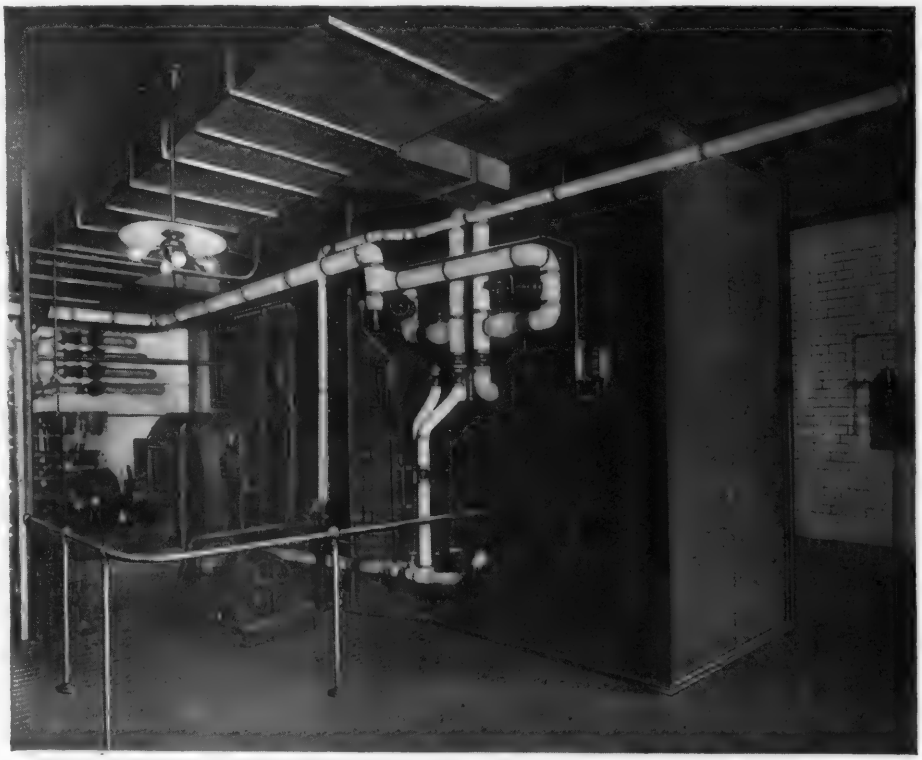
Established 1888. Branches in Principal Cities



STURTEVANT 7 x 7 AIR WASHER SHOWING PUMP DRIVEN B YA STURTEVANT MOTOR

In the Custom House in Baltimore is a

Sturtevant Air Washer
(REG. U.S. PAT. OFF.)

which conditions 20,000 cu. ft. of air per minute.

The large number of prominent buildings in which Sturtevant Air Conditioning Apparatus has been placed recently indicates its popularity among architects and consulting engineers. A few recent installations include:

South Side School, Minneapolis
Penobscot Bldg. Extension, Detroit
Deschler Hotel, Columbus
Cleveland City Hall
Oklahoma State Capitol
Boston Store, Chicago.

Our Air Washer Department will consult and co-operate with Heating and Ventilating Engineers.

B. F. STURTEVANT COMPANY
HYDE PARK, BOSTON, MASSACHUSETTS
AND ALL PRINCIPAL CITIES OF THE WORLD

Charles F. Hauss, of Milan, Italy, who has been in this country for several weeks for the purpose of making arrangements to represent American manufacturers of pig iron, molding machinery, foundry equipment and supplies in Italy, sailed for Milan, via England and France, February 28. Mr. Hauss, who is a charter member of the American Society of Heating and Ventilating Engineers, was one of the speakers at the February meeting of the society's New York Chapter.

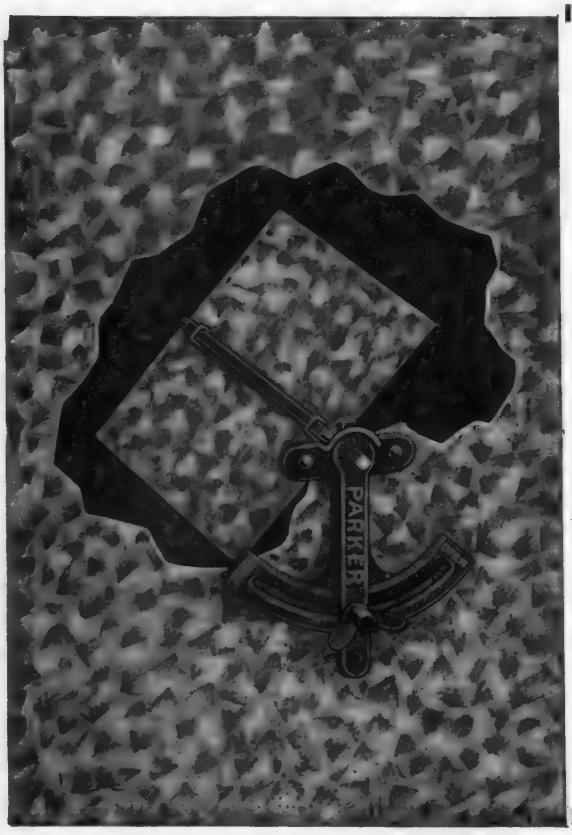
National Association of Master Plumbers, in sending out circular matter in connection with its forthcoming annual convention in Atlantic City, June 20-22, gives some interesting facts regarding the litigation which the association has had with the government over alleged infringements of the anti-trust law. In the Des Moines case, General Boyle, the association's chief counsel in the Western cases, argued the appeal before the United States Circuit Court of Appeals in St. Louis on January 3, 1916. The court now has the case under advisement and a decision may be expected in two or three months. The Salt Lake City case was set for March 6. The association desired to have this case postponed until a decision had been rendered in the Des Moines case and upon appeal to the attorney-general in Washington, a postponement was obtained until June, or until the Des Moines decision was rendered. The Erie case was expected to come up for trial the latter part of March, but following the postponement of the Salt Lake City case, it is thought the same procedure will be followed in the Erie case.

Central Station Heating Notes.

Abingdon, Ill.—Talk of a central heating plant in Abingdon to heat the business section of the city include a report that the laundry building will be used for a central station.

Davenport, Ia.—Plans are complete for the reconstruction of the city's heating system, which will be undertaken by the People's Light Co. The company will spend over $100,000 in building a new system through the business section of Davenport, the idea being to remove all of the present mains and replace them with new equipment.

Alta, Ia.—The town of Alta is out of debt, the council having paid off $6,200 bonded indebtedness on February 1. The municipality owns its own light, water and heating systems, free from indebtedness.



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PARKER DAMPER QUADRANT

—the ideal combination.

Have you a copy of our new booklet?

PARKER SUPPLY COMPANY

Makers of Expansion Bolts, Screw Anchors, Toggle Bolts and Sheet Metal Workers' Specialties.

515 W. 45th St., New York

Installed 26 Years Ago

It is more than 26 years since the above heater was installed at the Northwestern Casket Company in Minneapolis. The heater is still in satisfactory operation. A fan and engine were supplied at the same time. The vertical engine has been running ever since and during the last three years has been going night and day, Sundays and holidays shutting down only 18 hours a month when the boilers are washed out. This apparatus is used for drying lumber.

These are typical examples of the service rendered by Sturtevant Apparatus. It has acquired a reputation for a long life. It is built with a conscience and will give many years of satisfactory service.

Consult the largest corps of trained fan experts in the world.

B. F. STURTEVANT COMPANY HYDE PARK, BOSTON MASSACHUSETTS

And All Principal Cities of the World

Sturtevant

(Reg. U. S. Patent Office)

Oskaloosa, Ia.—A notice sent out by the Oskaloosa Traction & Light Company of a raise in its hot water heater rates, beginning March 1, led to a protest that was aired at a recent meeting of the city council. An effort was made to have the company defer the raise at least until the beginning of a new heating season. The raise proposed by the company was 25%. Action was put off until a later meeting of the council on the request of the attorney for the company, as well as on that of W. R. Lacey, one of the principal patrons in the use of heat.

Carroll, Ia.—The action of the Carroll Light & Heat Company in discontinuing its central heating service to the section north of Ninth Street has come as a hard blow to the patrons living in the section affected. They were recently called upon to accept a raise of 20% in the heating rates in order, as it was stated, to allow the company to get its plant in shape for future service. The question has been raised as to whether the north end service would not pay if the company would lay new mains and take on enough service in that part of the town to double its present revenue. The opinion of the company, it is stated, was that the service could be made to pay, but that the extra consumers could not be found. An independent investigation, it is claimed, shows that the company has had requests for heating service almost enough to double its present service, but that the new customers in the north end of town have been refused. As a retaliatory measure against the action of the heating company, a resolution was offered before the city council, prohibiting the erection or maintenance of any high-tension wires carrying over 2,500 volts of electricity in the city of Carroll. This would prevent the heating company from serving

AIR CONDITIONING
never involves too complex a problem if you avail yourself of our advice.
Carrier
Engineering Corporation
39 Cortlandt St., New York
Boston Philadelphia Buffalo Chicago

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Established 1879 CHICAGO, ILL.

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New York City

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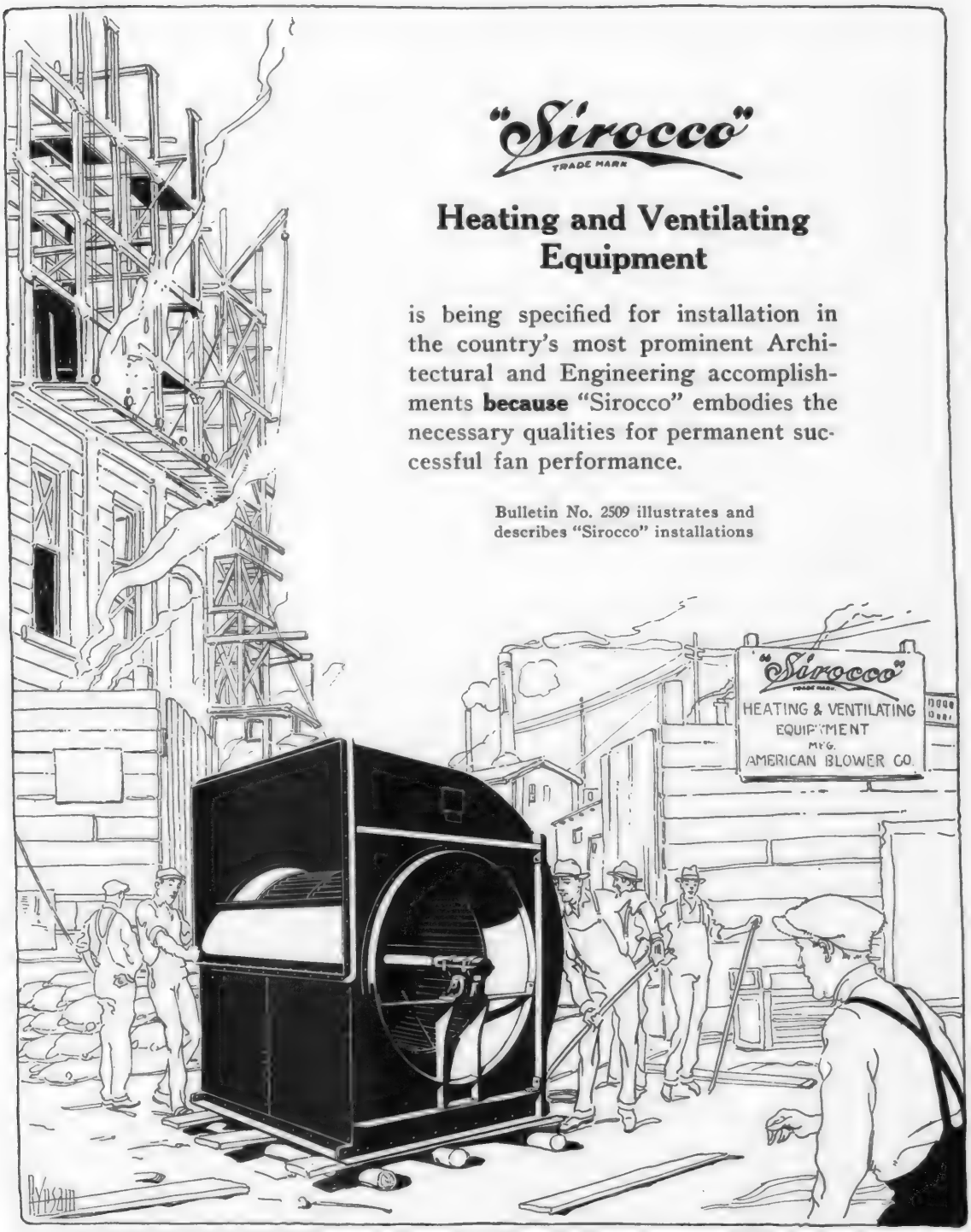
Penobscot Bldg.
Detroit, Mich.



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TRADE MARK

Heating and Ventilating Equipment

is being specified for installation in the country's most prominent Architectural and Engineering accomplishments **because** "Sirocco" embodies the necessary qualities for permanent successful fan performance.

Bulletin No. 2509 illustrates and describes "Sirocco" installations

AMERICAN BLOWER COMPANY
DETROIT, MICHIGAN

Manning and the other towns around Carroll with electric current, as is understood to be the company's intention. The resolution was not passed.

Grinnell, Ia.—A new corporation is being formed in Iowa, with headquarters in Grinnell, to be known as the Iowa Light, Heat & Power Co., of Boston. This company will take over all the properties in the State which it has acquired during the past two or three years, including the local corporation known as the Grinnell Electric & Heating Co. The new company will be the owner of 23 distinct concerns, and from these various points is already building transmission lines to surrounding smaller towns. H. C. Utter, of Grinnell, is a member of the board of directors of the new company and western manager of the parent company.

Spokane, Wash.—Speculation as to who is behind the Grinnell application for a central station heating franchise in Spokane became pronounced when the proposed franchise came before the city council for action February 14. The consideration of the application was put over until February 28. The possibility of the Washington Water Power Company using the franchise for the sale of electric light has been eliminated, it is thought, by the fact that this company's present lighting franchise, granted to the Edison company, still runs for a year or two longer than the proposed 25-year Grinnell franchise. It was also brought out that the franchise of the Spokane & Inland Empire Company, which owns the Nine Mile power plant, does not expire until 1945. Many opinions have been expressed that the duplication of service by the Grinnell system of the plant already in the field, operated by the Merchants' Central Heating Company, would prove costly to the public as in the end the State public service commission will allow each company to earn a fair return on its investment. Eventually, it was stated, the public will pay rates based on a double investment, whereas if but one company is in the field the public service commission will regulate the rates on the basis of a single investment for plant and equipment. Regulation of rates by the city council is also provided for in the franchise.

Experience has shown that where two franchises are granted one of three things have happened:

First—One or the other of the companies will buy out the second franchise.

Second—If two investments are made, eventually there will be a merger.

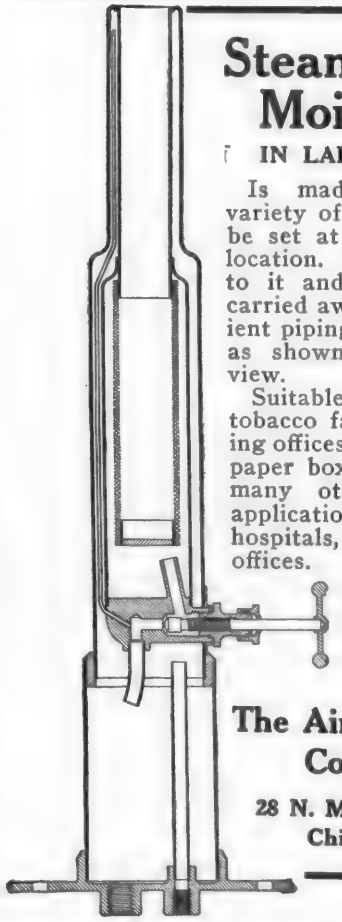
Third—If two companies remain in the field, there will be cutting of rates, which produces inferior service, and, as above, in the end, one of the companies will buy out the other so that ultimately it will resolve itself into one company.

Spokane has had its two gas companies, its two telephone franchises, and the result has been unsatisfactory to the people of Spokane, and the final outcome has been but one company, with additional financial burden to carry.

Manufacturers' Notes.

Standard Regulator Co., New York, will move to larger quarters at 90 West Street, where the company is now located.

Federal Radiator Co., New Castle, Pa., has been organized to take over the business of the Novelty Iron Co., Canton, O., and the entire plant of the Novelty Iron Company has been moved to New Castle. In connection with this change the company states that it now has one of the most modern and best equipped factories in the country for producing steam and hot water heating apparatus. The company will continue to make the well-known Nico boilers



Steamo Air Moistener

IN LARGE SIZES

Is made for every variety of service. May be set at any desirable location. Steam carried to it and condensation carried away by convenient piping of small size, as shown by sectional view.

Suitable for cigar and tobacco factories, printing offices, textile works, paper box factories and many other industrial applications as well as hospitals, schools and offices.

Send us your problem and we will figure it for you.

The Air Moistener Company

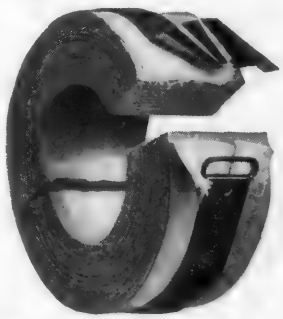
28 N. Market Street
Chicago, Ill.

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

J-M Responsibility—the logical outgrowth of over half a century's progress, achievement and business integrity—stands as a stronger assurance for your satisfaction than even the most complete written guarantee.

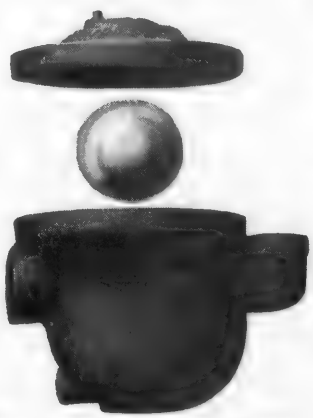
The difference between "pipe covering" and J-M Heat Insulation is the service rendered

Hundreds of plants are losing large sums annually in the cost of coal by allowing a large percentage of the heat units to escape from poorly insulated steam pipes. The one sure way of checking this waste in the plant of your design is by covering the pipes with the most efficient of all pipe coverings—J-M Heat Insulation. This insulation by actual tests, possesses from 15% to 30% greater heat-insulating efficiency than ordinary pipe coverings. Figured in dollars and cents, this means a saving which you cannot afford to overlook. Past experience proves this. For example, 2200 ft. of 6" pipe running out of doors was covered with J-M Insulation in 1881. It has been in constant use since that date and no expenditure has been necessary during that period for repairs. If you want to make a like saving, write the nearest J-M Branch today.



J-M Asbesto-Sponge Felted—One Style of J-M Heat Insulation

Stop and consider the 3-part simplicity of the J-M Steam Trap



The Cover, the Body, the Ball—that's all. Nothing to jam or catch—no levers to break, bend or corrode—no cotters to drop out—no danger of air-binding—no steam leakage. There is not a single complication inside the J-M Steam Trap. There is nothing to go wrong—nothing to repair or adjust. The rolling ball is normally held against the outlet orifice by steam pressure. As the condensate rises in the body of the trap, the ball is rolled up from the outlet. This releases the water, gas and air, which flow out continually as long as they come to the trap. Its construction is simple and its action is positive. Made in all sizes for all pressures.

Engineers are invited to consult any J-M Branch about the 3-part J-M Steam Trap.

Write for our literature on these products

H. W. JOHNS-MANVILLE CO.

Atlanta	Cincinnati	Los Angeles	New York	St. Louis
Baltimore	Cleveland	Louisville	Omaha	Salt Lake City
Boston	Denver	Milwaukee	Philadelphia	San Francisco
Buffalo	Detroit	Minneapolis	Pittsburgh	Seattle
Chicago	Indianapolis	New Orleans	Portland	Toledo

as well as a line of its own, and also a full line of radiators.

Richmond Radiator Co., New York, has opened a new warehouse in Philadelphia, at American and Dauphin Streets. The warehouse is a two-story building covering a site 80x80 ft., which the company has stocked with Richmond boilers and radiators.

Kelly & Jones Co., Pittsburgh, Pa., will open a branch office in Cincinnati, for the sale of its line of heating and plumbing goods. A five-year lease has been taken on quarters at Canal and Sycamore Streets, containing 30,000 sq. ft. of floor space.

Magee Furnace Co., Taunton, Mass., has its new plant in full running order, the company's working force having been transferred from the old plant at Chelsea. The new cupola has a daily melting capacity of 75,000 lbs. of iron. The officers of the company are: President, Joseph L. Anthony; treasurer, Robert M. Leach; secretary and general manager, Alfred W. Stockbridge.

Tillman Heating Devices Co., Indianapolis, Ind., has moved its main office and factory to Peru, Ind. A change has also been made in the company's name, the new title being the American Heating Specialty Co. At a recent stockholders' meeting, C. W. Ellis was elected president and H. A. Thrush re-elected secretary.

Richmond Radiator Co., New York, in its balance sheet for the year 1915, shows a total surplus of $63,377, an increase of $2,255, compared with the end of 1914. The report is as follows:

ASSETS.

Cash and cash items	$28,845
Surplus cash—invested in short term notes	75,000
Accounts receivable	295,818
Notes receivable—current	111,263
Merchandise, materials and supplies	594,732
Mortgages and securities	5,771
Real estate, plants, machinery, tools, etc.	908,352
Prepaid expenses, insurance, taxes, etc.	8,341
Preferred voting trust certificates	3,423
Patents, trademarks and licenses	2,811,857
Total	$4,843,402

LIABILITIES.

Accounts payable, etc.	$19,230
Mortgages payable	2,500
Accrued liabilities, taxes and sundry expenses	4,232
Miscellaneous reserves	26,818
Capital stock, preferred	1,575,000
Capital stock, common	3,150,000
Surplus	65,622
Total	$4,843,402

Walworth Mfg. Company's New York office, which is now under the management of Frank A. Bucknam, formerly general manager of the Nason Mfg. Co., New York, reports that its activities will be on a scale twice as large as formerly. The company, as already announced, has purchased the pipe business of Joseph E. Gallagher, at 19-21 Cliff Street, New York. The company's former New York office, at 42 Broadway, has been closed, and E. P. Keane, who was manager, now has charge of the export and tool departments at 19-21 Cliff Street. Many of the men who were associated with Mr. Gallagher have been retained by the new management.

Merchant & Evans Co., Philadelphia, Pa., manufacturers and dealers in metals and other products, including the Star ventilators, celebrated the fiftieth anniversary of its founding by removing its general offices and warehouse to a new location on Washington Avenue, Philadelphia, between 20th and 21st Streets. Here the company has erected a modern office and warehouse adjoining its former works. It also has plants in Philadelphia, Wheeling and Chicago. The company was founded in 1866 by Clark Merchant, a retired lieutenant-commander in the United States Navy, under the name of Merchant & Co., dealing principally in brass, bronze and copper in all their forms as then manufactured, and trading also in tin plates and other metals that were imported from England or other foreign countries. Recently the company has gone into the manufacture of gasoline motor trucks and tractor trucks.

American Radiator Co., Chicago, Ill., in its annual statement, reports the most profitable year in its history. This was in spite of a slight decrease in business for the full year. In the fiscal year ended January 31, 1916, the net profits of the parent company were $2,364,953, which, after the payment of 7% dividends on the $3,000,000 of preferred stock, left the equivalent of 26.33% earned on the $8,185,600 of common stock. The net profits of the foreign companies were $302,580, as against $495,655 the previous year, bringing the net profits for the year 1915 to $2,667,533. The surplus of the parent company was $7,972,842 and the aggregate surpluses of the foreign companies $6,699,031, making combined surpluses of $14,671,874.

President Clarence M. Wooley in his statement to stockholders said in part:

"The financial condition of the company is satisfactory. At the close of the year all current indebtedness had been paid and the company had cash on hand amounting to $2,700,580. The aggregate value of the tangible assets at home and abroad, including reserves, was $26,241,210. The net profits of the entire business, domestic and foreign, were equal to 10 per cent. of the tangible assets. Total cash dividends paid of $1,519,696 represented 5.8 per cent. of the tangible assets.

Davis Pressure Regulators Save Steam

DAVIS

When economy suggests or necessity demands the use of steam at less than boiler pressure use A DAVIS REDUCING VALVE.

This automatic device saves steam by delivering the exact amount required and no more. Being simple in construction and positive in action you may rely upon it for efficient service.

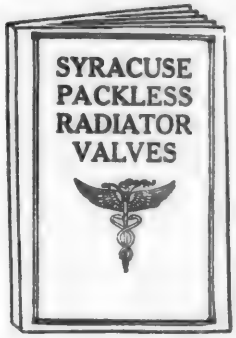
For forty years Davis Valves have been used by men of experience who demand the best possible results from their equipment.

G. M. DAVIS REGULATOR CO.
436 MILWAUKEE AVENUE CHICAGO
New York Boston Philadelphia Pittsburgh San Francisco

Send for Complete Catalog No. 8

VALVES

THREE NEW ONES



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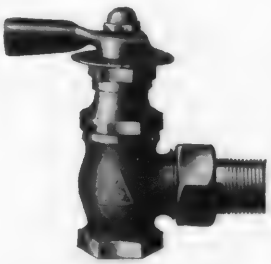
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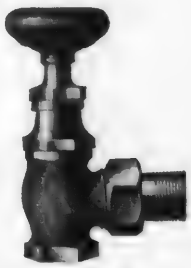

Style 38

ALL OF THEM DANDIES!

Send for the catalogue which tells about these new style valves.

SYRACUSE FAUCET AND VALVE COMPANY

Office and Factory
Syracuse, N. Y.

Sweet's Catalogue Page 1094
GEO. A. WELD CO., 79 Milk Street, Boston

220-224 West 42nd St.
New York City

"The foreign business was seriously affected by the war and while there has been a fair demand for the products of the European companies, their output due to existing conditions was limited, and resulted in a large curtailment of their sales."

The income account for the fiscal year ended Jan. 31, 1916, compares with the previous year:

	1916.	1915.
Net profits	$2,364,953	$2,289,075
Preferred dividends	210,000	210,000
Balance	$2,154,953	$2,079,075
Common dividends	1,309,696	*1,655,680
Surflus for year	*$845,257	$423,395

*Dividend $911,580 in cash and $744,100 in stock.

BALANCE SHEET

ASSETS.

	1916.	1915.
Real Estate, plants	$11,637,607	$11,400,223
Additions	640,514	537,383
Depreciation	300,000	300,000
Net	$11,978,122	$11,637,607
Cash	2,700,580	3,769,463
Notes receivable	174,860	267,406
Accounts receivable	1,291,690	1,430,804
Inventory	3,960,735	2,128,073
Total	$20,105,935	$19,233,354

LIABILITIES.

Preferred stock	$3,000,000	$3,000,000
Common stock	8,185,600	8,185,609
Receivables	947,492	920,169
Surplus	7,972,843	7,127,585
Total	$20,105,335	$19,233,354

Quick assets on Jan. 31, 1916, totaled $8,127,813 and were $7,180,320 in excess of current liabilities.

Campbell Heating Co., Des Moines, Ia., held a meeting of its salesmen recently, who are organized as the "Campbell Clan," and after partaking of a banquet at the Chamber of Commerce, listened to an address by Prof. G. K. Smith, of the extension department of the Iowa State College on "Furnace Heating," with special refeerence to technical details on the arrangement, size, shape and pitch of furnace pipes, etc. Sixty of the company's representatives were present, headed by President A. K. Campbell.

New Firms and Business Changes.

Freeport, Ill.—Manion & Shepley is the title of a new heating and plumbing firm in Freeport, composed of John Manion and Fred J. Shepley. Quarters have been taken at 171 Galena Street.

Fair Ventilator Co., Detroit, Mich., has increased its capital stock from $50,000 to $250,000.

American Warming & Ventilating Co., Indianapolis, Ind., has dissolved.

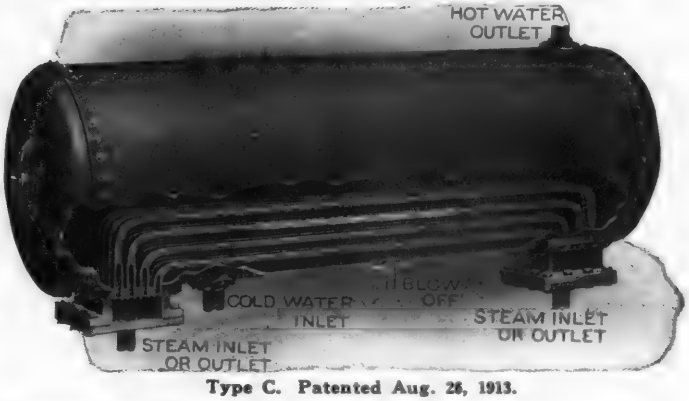
Bolton & Chapman, Inc., Detroit, Mich., is a new firm of contracting engineers for heating and ventilating and air conditioning plants, plumbing and sanitary systems.

THE ⌐¬ SHAPE TUBES EXPLAIN THE SUCCESS

of the

PATTERSON HOT WATER TANK

for heating water for domestic or manufacturing purposes. Both ends of each seamless brass tube are expanded into heavy cast-iron tube-heads with an improved roller expander. Their shape provides for the free contraction and expansion of each individual tube without straining, so there is no danger of leakage.



Type C. Patented Aug. 26, 1913.

Any Combination of Storage and Heating Capacities Can be Furnished. Send for Catalogue.

FRANK PATTERSON & CO., 26 Cortlandt Street, New York

Representatives in all Principal Cities

For Safety, Sureness of Operation and Durability

FOSTER PRESSURE REGULATORS

FOR STEAM HEATING SERVICE

(Classes "Q" and "Q H") lead the way. Designed especially for steam heating, and suitable for vacuum systems, for delivery pressure of from 1 to 15 lbs.

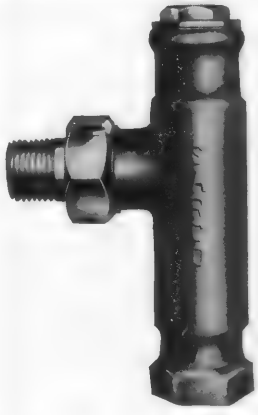
We make several types of pressure regulators—those shown in the illustrations here were designed particularly for steam heating service, and they are very sensitive, reliable, high grade in every particular and superior to other makes in construction and workmanship. There are no weights or close fitting pistons, and are easily adjusted to the desired pressure between 1 and 15 lbs. Made in sizes ¾ inch to 2 inches inclusive, composition body. Larger sizes are fitted with composition renewable seats.

Class "Q" Class "Q H"

These Valves are fully explained on Pages 29 to 33 of our General Catalogue, No. 20.

FOSTER ENGINEERING CO., Newark, N. J.

CHICAGO, ILL., 180 North Dearborn Street
PITTSBURGH, PA., 513 Park Building
PHILADELPHIA, PA., 601 Harrison Building
BOSTON, MASS., 161 Summer Street

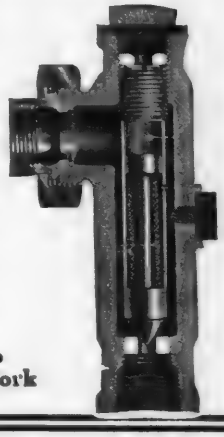


Radiator Trap

SARCO

Two Pipe Low Pressure — Vapor —Vacuum Heating Systems

Principle—Thermostatic
Motive Power—Liquid Expansion and Contraction



Positively noiseless in operation. No place for scale and dirt to lodge. Contact between head of valve and seat a line instead of surface. Distance inlet to outlet 3″ or 1¾″ and can be installed at any angle. Guaranteed not to stick or air bind. You cannot buy a more accurate Radiator Trap no matter how much more you pay for it.

Send today for list and trial offer

SARCO COMPANY, Inc., Old Colony Bldg., Chicago
South Ferry Bldg., New York

The firm is composed of James R. Bolton and Washington H. Chapman. Mr. Bolton is the son of George Bolton, inventor of the Bolton heater, and a heating and plumbing engineer of wide experience. Mr. Chapman was a member of the firm of Stahl, Kinsey & Chapman, architects and engineers, of Detroit. The new company's offices and shop are at 30 Baltimore Avenue, West.

Harold L. Alt, heating and ventilating engineer, recently with the Richard D. Kimball Co., New York, has engaged with Westinghouse, Church, Kerr & Co., 37 Wall Street, New York, where he will have charge of that company's plumbing designing and also will do work for the heating department.

Walter S. Appleton, Inc., New York, recently incorporated by Walter S. Appleton and Harry D. Liptrott, has opened quarters at 1481 Broadway, at the corner of Forty-second Street, where the company will carry a complete line of the Marsh double-seat radiator valves.

Columbus Heating & Ventilating Co., Columbus, O., has taken over the heating and ventilating contracting business of the Lamneck Co., of Columbus, and will take care of the Lamneck Company's unfinished contracts. A. P. Lamneck, formerly president of the Lamneck Co., will act as a traveling salesman for the Columbus Heating & Ventilating Co. His brother, W. E. Lamneck, will continue the house heating, roofing and sheet metal business of the Lamneck Co.

Teran, Mahaney & Munro, Inc., New York, heating and ventilating and power plant engineers and contractors, have moved to new quarters in the Grand Central Terminal Building, Forty-second Street and Park Avenue.

New Incorporations.

Ivor Heating Co., Kalamazoo, Mich., capital $10,000, to manufacture hot water heaters.

American Blow Pipe & Ventilating Co., Chicago, Ill., capital $2,500. Incorporators: Andrew H. Anderson, Daniel Bell, Otto Butzbach and Joseph F. Fernoch.

O'Rourke Heating and Ventilating Co., Newark, N. J., capital $10,000. Incorporators: Christopher A. O'Rourke, John J. Berry and William P. Berry, all of Newark.

Colton Co., Des Moines, Ia., capital $25,000, to deal in heating appliances. President, W. L. Colton; secretary, W. J. Col-

ACCURATE SERVICE

That is the strong point with Mueller Reducing and Regulating Valves. They never fail to yield it when they have been properly installed.

13160

If you are troubled by some perplexing pressure problem take the question up with us. In the Mueller line there is certain to be found just the valve you want.

There is no better all around valve made than the 13160. It's good on steam, water, air, oil, etc. Ask for our No. 5 Regulator Catalogue.

H. Mueller Mfg. Co.

Decatur, Ill.

145 W. 30th St. New York
589 Mission St. San Francisco

Combination Ozonator and Electric Fan

SPRAGUE ELECTRIC OZONATORS

eliminate unpleasant odors, keeping the air pleasant and

WHOLESOME

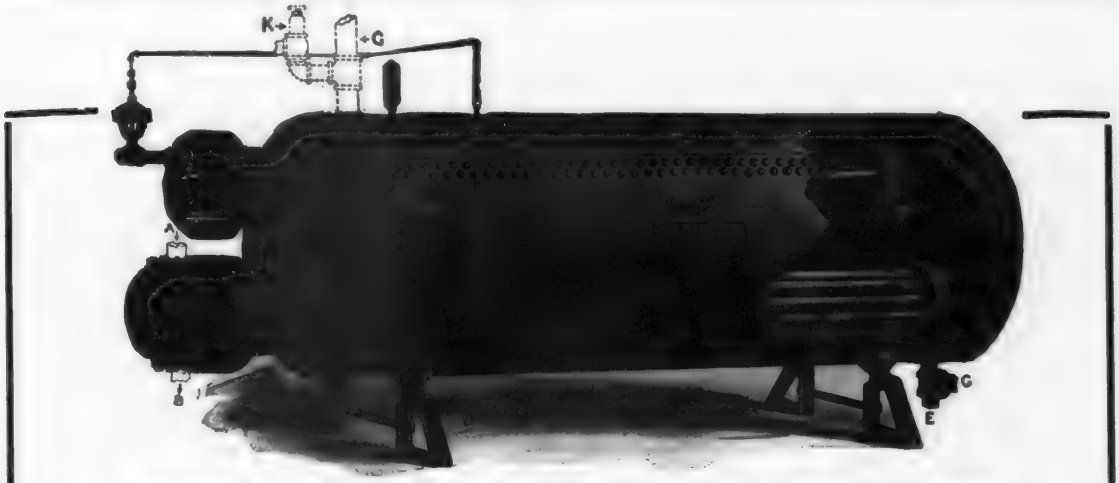
1. Low Cost of Operation.
2. Efficient and Reliable.
3. Metallic Construction.
4. These Ozonators are approved by the National Board of Fire Underwriters. Write for prices and a copy of Bulletin No. A-83.

SPRAGUE ELECTRIC WORKS

OF GENERAL ELECTRIC COMPANY

Main Offices: 527-531 West 34th Street, New York, N. Y.

BRANCH OFFICES IN PRINCIPAL CITIES



WHEN THE HOT WATER DEMAND RUNS HIGH

Our large experience in manufacturing heaters for laundries has developed the fact that there is not always enough exhaust steam to heat all the water to the temperature required. This is always the case with a wet-wash laundry. For a high hot water demand use the

SIMS CLEAN E-Z HEATER, TYPE D.

This heater is supplied with two sets of straight, seamless drawn brass tubes, the lower for exhaust steam, located in the coolest water. The upper set of tubes is for live steam direct from the boiler, controlled by a thermostat.

Our Bulletin HL-2 gives full particulars of Sims Heaters for laundries, hotels, hospitals and other service. Consultation free. All work guaranteed.

THE SIMS COMPANY **18th Street, Erie, Pa.**

ton. Directors: W. L. Colton, E. G. Brewer, H. A. Bacchus and N. S. Colton.

R. C. Beverly Heating Co., Richmond, Va., capital $25,000, to manufacture heating specialties. President, R. Carter Beverley; secretary and treasurer, E. C. Beverley.

Hynds Curtin Plumbing & Heating Co., La Salle, Ill., capital $5,000. Incorporators: John Hynds, Michael J. Curtin and Mae Hynds.

Anderson-Deering Co., Boone, Ia., capital $10,000, to engage in the steam fitting and plumbing contracting. President, Andrew G. Anderson; secretary, James J. Deering.

Iowa Light, Heat & Power Co., Grinnell, Ia., capital $1,000,000. President, Lindsey Hooper; vice-president, Manning A. Williams; secretary, Charles A. Olson.

Walter S. Appleton, Inc., New York, incorporated to conduct a general real estate agency, brokerage business and to deal in boilers, radiators, steam and plumbing specialties. Incorporators: Walter S. Appleton, Harry G. Liptrott and Walter L. Curack, Jr., all of Manhattan. Mr. Appleton was formerly New York manager for the United States Radiator Company and later was connected with the New York office of the Richmond Radiator Co.

Plattsburg Plumbing & Electric Co., Plattsburg, N. Y., capital $10,000, to take over the business of the H. C. Hapgood Co. Among those interested are Charles E. Bragg and Frank L. Carroll, of Glens Falls, N. Y.

Clark Plumbing & Heating Co., Cohoes, N. Y., capital $3,000. Incorporators: David Clark, Harry B. Clark and William B. Clark.

Modern Plumbing & Heating Co., Chicago, Ill., capital $2,500. Incorporators: Rudolph Groll, I. Muller and Jacob Levy.

Rehill Plumbing & Heating Corporation, Bridgeport, Conn., capital $5,000.

Fisher Heating Co., Memphis, Tenn., capital $15,000, to conduct a heating, plumbing and gas fitting business. Incorporators: John M. Groner, William P. Metcalf and J. Earl Allen.

Lyon Ventilating Machinery Co., Inc., New York, capital $5,000, to deal in ventilating, cooling, lighting and refrigerating machinery, etc. Incorporators: E. Kobbe, W. G. Keil and D. T. Lyon.

Chippewa Plumbing Co., Buffalo, N. Y., capital $5,000, to conduct a heating and plumbing business. Incorporators: J. W. Hyland, C. Jolindahl and A. A. Hoestermann. Quarters have been taken at 88 West Chippewa Street.

Yahraus Plumbing & Electrical Co., Cleveland, O., capital $10,000. Incorporators, J. O. Anderson, James G. Brown and Joseph Zralek.

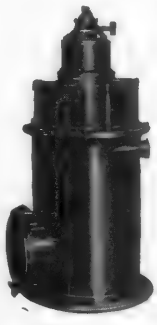
Johansen-Duell Co., Norfolk, Va., capital $10,000, to conduct a heating contracting business. President, Gotfred Johansen; secretary and treasurer, R. D. Duell.

Eureka Smokeless Furnace Co., Chicago, Ill., capital $30,000, to manufacture boilers and furnaces. Incorporators; Neils Buck, Herman T. Becker and M. J. Mears.

Unit System of Heating & Mfg. Co., Pasedena, Cal., capital $50,000, to manufacture heating specialties. Incorporators: Charles Atherton, S. L. Roland, J. P. Chandler and H. W. Wright.

Business Troubles.

Acme Electric Heater Co., Detroit, Mich., has filed a petition in bankruptcy in the United States District Court. Liabilities are placed at $33,227.52 and assets at $48,403.



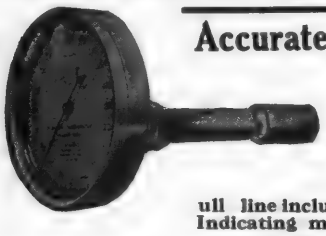
Spencer Turbine Vacuum Cleaners

are manufactured in sizes from ¾ H. P. to 40 H. P.

Send for catalogue

SPENCER TURBINE CLEANER COMPANY

¾ H.P.Equipment HARTFORD, CT.



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Standard Indicating and Recording Thermometers

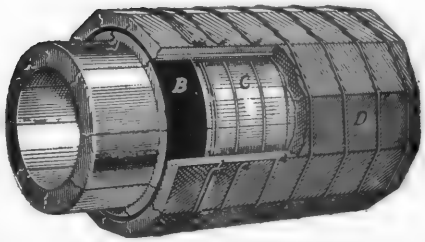
Guaranteed Correct

ull line includes seven types of recording thermometers and a special line for mechanical uses Indicating mechanical thermometers are furnished with extensions from 2 to 30 in. in length

All thermometers are double and not breakable.

STANDARD THERMOMETER COMPANY Clinton and Shirley Streets **BOSTON, MASS**

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes

WITH WYCKOFF'S IMPROVED

CYPRESS COVERING

Made of Gulf Cypress, the wood eternal

Not affected by wet and dry conditions common to steampipe trenches. Will not rot. Lasts twice as long as Pine Casing. Absolutely water and steam tight. Each shell is wound with heavy galvanized wire. Coated all over with the best known preservative—Hydrolene B.

Let us answer your questions and tell you all about it. Booklet on request.

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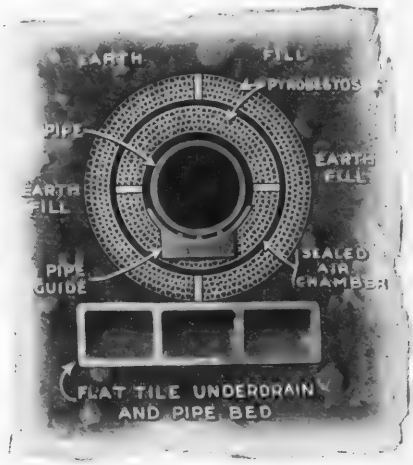
Chicago, Ill., 551 West 14th Place
Pittsburgh, Pa., Johnson-Peter Co., Pittsburgh Terminal Warehouse



Pyro-Bestos Underground Pipe Insulation

For piping from central heating or power station to detached buildings of Universities, Asylums, Hospitals, Factories, etc. Also as underground Pipe Conduit for heating private Auto garages direct from House heating system. Lasts longer than Wood; in fact indefinitely. Easily applied and of reasonable cost. Is water repellant,—does not absorb moisture like Magnesia, Infusorial Earth or the loose filling in Tile Conduit systems, all of which materials acting like a wet sponge held against the piping soon rust holes in the piping. We have cases on record where Insulations of the absorbent type have totally destroyed the piping in five years and less after installation, making it necessary to go all over again with the cost of digging trenches, new piping and new Insulation. No material of an absorbent nature should be placed around underground piping. Test all underground Insulations offered you by placing a fragment in a glass of water. If it absorbs water, don't use it.

National Air Cell Covering Co.

210-220 Van Brunt St., Brooklyn, N. Y.

Contracts Awarded.

Peter Eckzeler, St. Louis, Mo., steam heating and plumbing high school building in Springfield, Ill. The building will cost $400,000.

Linehan & Molo, Dubuque, Ia., heating and plumbing new Sacred Heart Parochial School in Waterloo for $10,735. A central heating plant will be installed to take care of the school, Sacred Heart Church and the sisters' home.

Columbus Heating & Ventilating Co., Pittsburgh, Pa., heating and ventilating new high school building at Lehighton, Pa., for $8,535.

Turner Co., San Francisco, Cal., heating and ventilating Wheeler Hall at the University of California.

M. W. Townsend, Martinsville, O., installing mechanical equipment in the new court house and jail at Wilmington, O., including heating and plumbing apparatus, for $21,096.

J. W. Anderson, Nashville, Tenn., heating and plumbing Tennessee Polytechnic Institute at Cookeville. Separate heating equipment will be installed in the two dormitory buildings and in the administration building.

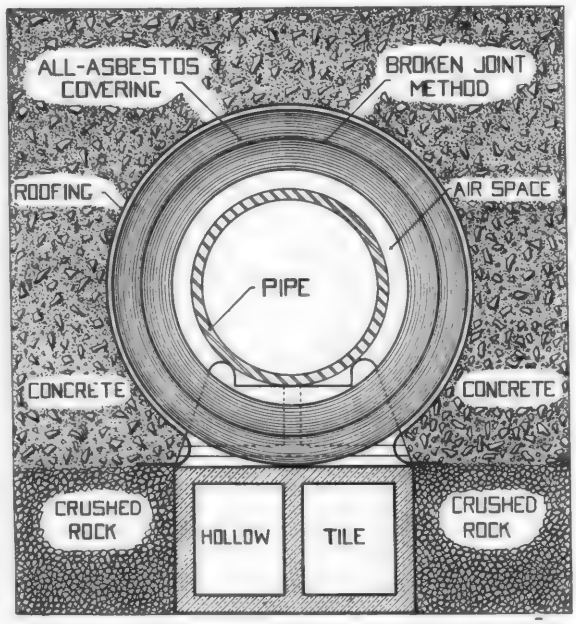
Collins Plumbing & Heating Co., Great Falls, Mont., heating Grand Theatre, in that city, for $5,000.

Victor Plumbing Co., Springfield, O., furnishing and installing four boilers for heating the new Memorial Hall. The boilers will have a capacity of 13,500 sq. ft. of radiation and the contract amounts to $30,000.

F. G. Leadley, Lansing, Mich., heating and ventilating new Michigan Avenue School, in Lansing, for $5,880.

T. M. Barr, Salem, Ore., heating Oregon Agricultural College buildings at Corvallis, Ore., for $4,424. Other bids were: W. G. McPherson Co., Portland, $5,177; Appling & Griggs, Portland and Tacoma, $4,835; J. F. Shea, Portland, $5,181; Finnigan Bros. & Hill, Portland, $5,339; Kendall Heating Co., Portland, $4,850, and A. C. Freeman, Corvallis, $4,461.

New Haven, Conn.—Bids were received as follows for heating the City Hall, police building and the old county building on Church Street, the bids covering three systems of vacuum heating: Rourke Bros., $8,340, $7,874 and $7.700; John B. Beegan, $12,487, $13,808 and $12,308; John W. Ihne, $10,260, $8,800 and $9,142; Sheahan & Groark, $10,559 (Dunham system), $10,559 (Webster system); Taylor, Flagg & Co., Meriden, $8,675 (Dunham system); Buck-



A type of Heating Mains with few specials—easily installed—permanent

INDESTRUCTIBLE

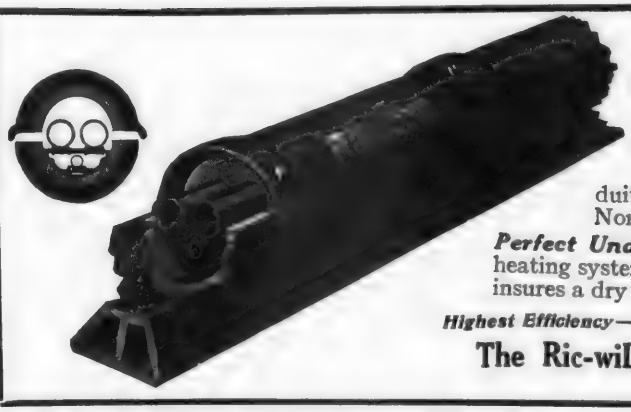
Conduit is made of CONCRETE and every LOCALITY "has the MAKIN'S"

Let me furnish you the covering, expansion joints, etc., together with complete specifications to meet your case.

Ask for quotations or estimates.

J. C. Hornung, Engr.

111 West Monroe Street Chicago



Ric-wiL MethoD
of
Insulating Underground Pipes

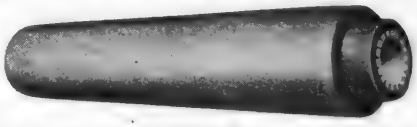
Double Insulation — Diatomite composition moulded onto the conduit. (Conduit is serrated to hold insulation.) Loose Non-settling Ric-wiL Asbestos Silica Fibre.

Perfect Underdrainage—The life of any underground heating system. Ric-wiL Interlocking Base Drain always insures a dry ditch.

Highest Efficiency—Lowest Installation Cost—Permanent

The Ric-wiL Co. 623 New England Bldg. CLEVELAND OHIO

STANDARD
Steam Pipe Casing



For Insulating Underground Steam Pipe. Tin Lined, or Unlined.

Every salesman has his argument in order to sell the product he represents. Listen to our argument, be the judge, and you will find same not theoretical but practical, and from actual experience.

When you cover your steam line with our make of casing you have the assurance that the line will be constructed so that no heat will escape, and will be water tight as well, with ample space for air chamber.

Should occasion arise that it is necessary to get at the steam pipe, our covering CAN BE TAKEN APART WITHOUT DESTROYING THE STAVES in the sections of casing, and the same casing can be used again. LET US EXPLAIN HOW.

If your line runs in different branches we will build the casing in exact lengths so that you will not have to cut any sections, which means no waste or extra expense to you.

Our method of building covering will be to your interest. Our product is right, attention prompt, and prices low.

SEND FOR BOOKLET

Standard Wood Pipe Co.
WILLIAMSPORT, PA.

The Mouat Vapor Heating System

To Sell the Mouat System is to Assure Mutual Satisfaction

The Mouat Graduating Vapor Heating System embodies a number of features which afford a degree of comfort and convenience almost unbelievable by those not familiar with this system.

The Mouat System uses vapor as the heat carrying agent. It furnishes absolutely positive graduation of heat to conform to sudden temperature changes. The temperature of any room can be regulated by the occupant to suit his own ideas. Very little attention is required to obtain the best results, as the system operates at from one ounce or less up to 3 ounces of pressure and has a particularly close draft and pressure regulation. It is practically impossible to burn more coal than will entirely heat the radiators.

The selling agency for The Mouat System has invariably proved to be an invaluable asset. If you are interested, write for catalog and booklet, "The Attainment of Perfect Heating."

Manufactured by
The MOUAT SQUIRES Co.
Cleveland, O., U. S. A.
At 1244 W. 4th St.

ECONOMY VACUUM PUMPS

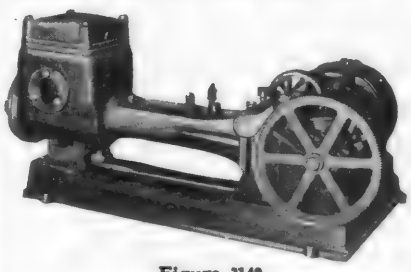


Figure 2149
Economy Motor Driven, Direct Acting Vacuum Pump, Double Acting Type

A PUMP FOR EVERY PURPOSE

Vacuum Pumps, for two pipe or air line systems—automatic electric or hand control.

Automatic Condensation Pumps and Receivers.

Economy Pumping Machinery Co.
116-118 N. Carpenter St., Chicago
Phones—Monroe 5941-5942

ingham, Routh Co., $12,412 (Dunham system) and $8,750 (Webster system); John D. Kelly, $11,368 (Dunham system) and $11,432 (Webster system). The third system under consideration is the Bishop-Babcock-Becker Reliable system.

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the folowing named work:

Until April 19, 1916, for the construction complete of the U. S. Post Office at Arkadelphia, Ark.

Until April 24, 1916, for the construction complete of the U. S. Post Office at Roseburg, Ore.

Until April 26, 1916, for the extension and remodeling, including mechanical equipment and approaches, of the U. S. Post Office and Custom House at Evansville, Ind.

Until May 8, for the construction complete of the U. S. Post Office at Elkins, W. Va.

Portland, Ore.—Jay H. Keller, constulting engineer, is preparing the plans for the mechanical equipment, including heating and ventilating, for a new $50,000 building for the University of Oregon at Eugene. Architects, Lawrence & Holford, Portland.

Manufacturers' Publications.

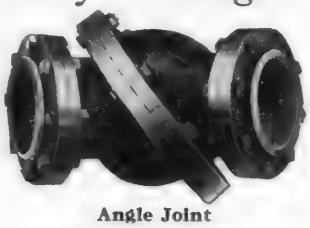
IDEAL HEATING JOURNAL for February, 1916, the periodical of the American Radiator Co., Chicago, Ill., gives the particulars of a "Test of Sylphon Control on Barometric Condenser," by H. H. Hughson. Another article tells how to make calculations of smoke density, using the Ringelmann charts.

VALVE WORLD for March, 1916, the monthly periodical of the Crane Co., Chicago, Ill., has as its principal article an illustrated discussion of wrought iron, being the sixth installment of "Non-Technical Chats on Iron and Steel and Their Application to Modern Industry," by L. W. Spring, the company's chief chemist and metallurgist.

World's Salesmanship Congress.

Plans are going forward for a World's Salesmanship Congress, to be held in Detroit, Mich., July 9-13, 1916. The object of the congress is to advance the science of salesmanship in preparation for the trade war which, it is expected, will follow a declaration of peace in the Old World.

In "pipe fitting" if your flanges do not face up, don't worry. You will not have to bend your pipe or face off your flanges if you



Angle Joint

Use the "ADSCO"

Angle Joint

It will fit any place, good for any angle from 90 degrees to a straight line, and made in all sizes.

Let us help overcome your troubles.

Write today for prices

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A Book with Government Data

on

Heating and Ventilation

Heating Factory and Other Buildings

Forced Hot Water Heating from a Central Station

Plumbing, Drainage and Water Supply

Gas Piping

Conduit and Wiring Systems

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Small Power Plants

Motors and Controlling Apparatus

Vacuum Cleaning Systems

Nelson S. Thompson's "Mechanical Equipment of Federal Buildings"

(Third Revised Edition)

An Invaluable Data Book for Heating Engineers and Contractors, Architects, Practical Engineers and Plumbers

CLOTH $3.00 NET

Size 6 x 9 in. 400 pages. (Rewritten, revised, enlarged)

Published by the

Heating and Ventilating Magazine Company

1123 Broadway, New York

You've Been Wanting an Expansion Joint Like This!

Whether your view point is that of the owner who pays for the equipment or of the engineer who uses it, you will be interested in this joint. It is absolutely reliable, never requires packing, cannot get out of order and will last a life time. It is not expensive. It is called the

BADGER Self Equalizing Expansion Joint

Built of one piece of corrugated copper, it takes up expansion on the principle of an accordion. It is reinforced by equalizing rings which distribute the expansion equally among the corrugations. For community heating systems requiring long pipe lines, it is ideal, as it may be forgotten after it is installed. Its diameter is but slightly larger than that of the pipe itself. This joint is made for any size and any pressure. Our free catalogue tells all about it. Write for your copy.

E.B. BADGER & SONS CO.

63-75 PITTS ST. - - BOSTON, MASS.

50-89

Burns Pea Coal
Burns Soft Coal

WITHOUT SMOKE

Saves 40% In Fuel
50% In Labor

(Manufactured under Surrell Patents)

Build Up Your Trade on the Molby Boiler

Satisfied Users are your best business asset and every Molby installation will add to your reputation.

ECONOMY, CONVENIENCE, ADAPTABILITY

Economy—40% in fuel saved.
Convenience—50% in labor saved.
Adaptability—Burns soft coal without smoke

Let Us Prove THIS!

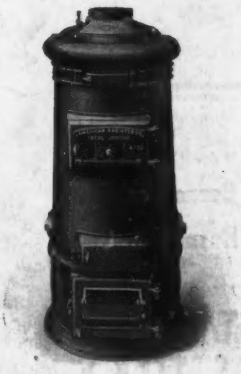
Write for test data and records from typical installations. Catalogue on request.

MOLBY BOILER CO., 39 Cortlandt St., New York

Start spring business

No. 10 Ideal Arco

The need for a hot water supply after the heating boiler, with its coil, has been shut down, will soon confront many house-owners. Why not start right now to secure additional business by looking up those for whom you installed heating plants last fall and advising them, as well as all inquirers, to put in an



No. A-12 Ideal Junior

IDEAL Hot Water Supply Boiler

The steady reliability of a hot water supply from one of these small boilers is one of the comforts which makes an owner feel that his home is just a little bit the most satisfactory home in the world.

No. 152 Ideal Premier

Their low first cost and the mere nominal expense of upkeep, as pointed out by all enterprising contractors, will appeal to the frugality of the average house-owner. IDEAL Hot Water Supply Boilers add to the comfort of living and reduce the high cost of living.

No. 1-D Ideal Laundry

For easy computations of sizes, ratings, etc., see special tables and other information on IDEAL Hot Water Supply Boilers in the "Ideal Fitter."

AMERICAN RADIATOR COMPANY